SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

COAL MINING IN THE COUNTY OF DURHAM.

PELTON COLLIERY, situated one mile from Chester-le-Street, is rried on by Lord Dunsaney and partners, with Mr. Wm. Armstrong consulting mining engineer. The minerals belong to the owners, the Earl of Durham and others; over 1600 acres are attached to e colliery. The seams at present available for working are the Low ain, Hutton, and Harvey seams. The Main coal and Maudlin ams, found above the Low Main, have been worked in this locality an early period. The Main coal is found in the present pits at the pth of 12 fms. from the surface, and exists only on the higher ound of the property. This, with the Five-quarter and Shield-row ams (which are worked in the high ground to the west in the Tanld district), have all been subject to denudation, the Shield-row am being altogether wanting in the Pelton property. Midway beeen Pelton and Chester-le-Street the Main coal, and probably the onstone balls in the thill of it, were worked at the latter part of the th century by the owner of the Whitehill estate. The ironstone as smelted in a blast-furnace, erected at this spot, and water-power as made available for the blowing-machinery. At the foundry atched to the furnace cannon were manufactured for the British overnment during the French war. However suitable the local onstone would be for this purpose, it is altogether inadequate to the mands of the present day in point of quantity and cheapness. The dustry of the district has been turned into other channels; the obct sought to be attained in its pursuits is the preservation of human e, instead of wantonly destroying it.

The plant at Pelton Colliery originally consisted of two 7-ft. pits, parated by 7 ft. thickness of strata, one engine winding from th; one pumping-engine and shaft for pumps near the others; the cast or furnace pit was about 450 yards northward. All these are k to the Hutton seam, and about 54 fms. in depth. At the present ne, besides the two 7-ft. pits, another pit, about 30 yards north of em, has been sunk to the Harvey seam, 10½ ft. in diameter, 94 fms. depth, and a winding-engine erected for raising coal. Another to the Harvey seam is sunk as a return air-pit, on which is erected Guibal fan. Another pit is sunk as an air-pit to the Hutton seam, which is erected a Waddell fan. A pit has recently been sunk to e Hutton seam as a return for the exhaust steam of the underound engines, and in which the pipes to convey steam from the ilers are placed. This pit, it may be observed, is 7 ft. in diameter the clear, and was sunk 54 fms. in 10 weeks, and afterwards walled om bottom to top.

The three air pits are in close proximity to the coal pits; only one is in action at once, that out of use being shut off from the ine by doors both at the top and bottom of the pit. The pumpinggine at the top of the pump-shaft has been stopped for some time; was built in 1836, and is on the atmospheric principle, the cylinder en at top, is 72 in. diameter, 6-ft. stroke; it raised water from the itton seam with one bucket-lift of 41 fathoms; an off-take drift 13 fathoms from the surface was used in conveying the water from is point. The winding-engine at the two 7-ft. pits was erected in 9 by T. Murray, of Chester-le-Street (the original winding-engine still standing with the boilers, but not used); it has a 40-in. cylder, 5½-ft. stroke, with levers, direct-acting 16-ft. drum for round re ropes, 20-ft. fly-wheel, around which the strap of the foot-break is. There are three plain cylindrical boilers, 40 ft. by 6 ft., hand d. The pressure in the boilers is 15 lbs., the steam is condensed, vacuum gauge shows 11 lbs. This engine is fitted with a dial licator, and the chain and bell indicator; it has also Musgrove's tent indicator; the number of the raps from the pit strike on a l, and there are at the same time indicated on a dial at each lift. ecoal raised by this engine averages 850 tons per day. One singleked cage in each pit, in which are raised two 8-cwt. tubs side to le. The Harvey pit winding-engine was built in 1865 by Joicey, Gateshead; it has not raised coal during the last 18 months, and used only to raise water by tanks from the Harvey seam, 94 fms., hort time each day. It has one 36-in. horizontal cylinder, 6-ft. oke, direct-acting, round wire-rope drum, 17 ft. diameter at the es and 18 ft. at the middle; there are four double-beat valves rked by a rod and crank from the main shaft. Nine plain cylinical boilers supply this engine, the fan engines, two small engines the boilers, and three underground engines. Eight of these boilers ve Juckes's firing apparatus applied to them; these are driven by small engines, one in use at once. The boilers are fed by one of meron's steam-pumps, with two inverted cylinders and two rams. each boiler Hopkinson's compound safety-valve is fitted; the nciple of this is that a bell is sounded either with any over presof steam or a short supply of water. The pressure of steam intained in these boilers is 35 lbs. per inch; the engines are all -condensing. Six boilers are 40 by 5 ft.; two, 30 by 6 ft.; and , 24 by 6 ft. The cages for the Harvey pit are single-decked, each rrying two 8-cwt. tubs, end to end.

UNDERGROUND WORKINGS.—About three-fourths of the coal raised got from the Hutton seam, the remainder is got from the Low Main m, which is sent down in cages by a 9-fathom drop to the Hutton m, a little north of the 7-ft. pits. In the Hutton seam the hauling ll effected by engine-power (sometimes to the extent of 800 tons day), except at the working extremities, where five horses and all ponies are employed. The hauling-engine, placed near the ttom of the Hutton seam pits, has two 24-in. horizontal cylinders, ft. stroke, on second motion, as 3 to 2: two 5-ft. wire-rope drums. is engine also pumps the water from this seam at nights, by means two double-acting 7-in. force-pumps, placed immediately behind steam-cylinders, and 7-in. main-pipe up to the surface. By this rangement the operations of the pumping-engine on the surface ve been superseded. From the bottom of the pits the main road s south about 40 yards, then to south-west about 40 yards more, ich forms the bank-head. The hauling-engine is placed at one e of the pits, and draws the wagons to and from this point, inrds: outwards to the pits the wagons are drawn in and out by a all horizontal engine, placed near the large one, with one 10-in. izontal cylinder, on second motion, 3 to 1, and two 3-ft. drums. e rope is attached to each drum, and passes round a sheave at the nk-head; the wagons are attached by a short chain to links in the e at intervals, so that they are drawn in and out alternately. esuming the description of the engine-plane from the bank-head, the road from thence proceeds west 350 yards, and all the Hutton seam coal is brought through this portion. At this point the road divides, one part going west about 800 yards, with a south branch from it of 700 yards in length; the other part goes north from the end of 350 yards to the extent of 2200 yards, having two west branches out of it, and an east branch of 800 yards; but the latter was 1100 yards east and 500 yards north of that again; this, however, has been reduced, as the coal is now being worked back. This extremity was 2½ miles distant from the pits. The total rope now used is about 10½ miles—3½ miles of 3-in. main-rope, and 7 miles of 2½-in. tail-rope. The main-rope is divided into ten sections, which can be connected or disconnected as required, by means of a shackle at each branch end. The tail-rope is similarly divided. The rule is, when a full set of wagons is drawn out from any branch to the bank-head the empty set is drawn into the same branch; the engine is then at liberty to draw from any other branch, after the ropes are suitably connected. There are five vertical return sheaves, 6 ft. diameter, for the tail-ropes at the extremities. The tail-rope is carried on pulleys at the roof of the roadway. From 50 to 90 wagons are drawn at once with each journey. The 350 yards section of the ropes is used with every journey; the other parts are more or less dormant in each journey. Two 10-in. pumps and one 7-in. pump drain all the dip workings of this mine. The pumps are worked by bending the rope out of its course over two shieves, the friction on which gives motion to the pumps. The main drifts, west from the pits, have lately passed through a succession of faults, both upthrow and downthrow; as the effect of these, the coal is elevated about 30 ft., and a stone drift is now being driven to reach this point. Section of the Hutton seam at the face of north headways on these faults:—

1.—Post, or sandstone.		
2.—Blue metal (good roof)	5 ft.	6 in.
3.—Good coal	3 ft.	10 in.
4.—Shale	0	1
5.—Coarse coal	0	5=4 ft. 4 in.
6.—Underclay (with balls of mine).		

The rise of the measures is nearly west 1 inch per yard. The cleavage runs north 11 west, or south 11 east, in this seam. The coal is worked on the bord and pillar system; the bords 4 yards, the crossholes 2 yards wide, and the pillars are made 25 yards square. The bords are driven in panels of 12 or so, either west or east, against the cleavage. Lamps are used both in the whole and pillar workings. The pillars are worked off by lifts, half on each side of the headway. The pillars are not worked nearer than five or six pillar lengths from the whole workings, where powder is used. The production of gas from this coal is considerable, requiring strong currents of air to dilute it, more so than the Harvey seam; the gas from the Low Main seam is inconsiderable. The total quantity of air in circulation in the three seams is over 100,000 cubic feet per minute, 62,000 of which pass through the Hutton seam workings. Constant attention is paid to the indications of the barometer, as it is found that a great decrease of atmospheric pressure is quickly indicated by the appearance of gas at the goaf sides.

The Low Main seam, 9 fms. above the Hutton seam, is 3 ft. 2 in. in thickness of clean coal; it is worked on the bord and pillar system, and has a good roof. The pillars are made 30 by 25 yards. Candles are used in the whole, and lamps in the pillar workings. The cleavage is the same as in the Hutton seam. Horses are used for hauling. The Harvey coal is of the coking quality; no coke ovens are built. The section of this seam is—

1.—Grey metal roof, moderate.		
2.—Coal	2 ft.	10 in.
3.—Strong band of shale	0	4
4.—Coal	0	8
5.—Shale band	0	0½
6.—Coal	2	6=5 ft. 10½ in.

No workable seam has yet been found below the Harvey seam, though the Brockwell appears as a workable seam in other districts.

VENTILATION OF THE MINES.—As already stated, there are three distinct air-pits, two in connection with the fans, and one for the exhaust steam, the downcasts being the three coal shafts, and the pump-shaft if required. This form of mechanical ventilation, with two fans, and air-shafts appropriated to them, will, no doubt, take precedence of all other systems, both for safety and efficiency. The cost of sinking the air-pits will, in many cases, operate against its adoption, but the system of duplicate fans is proved at Pelton to be far superior to the furnace at its moderate depth, and to the depth of about 600 yards continues to have the advantage in economy of fuel, even with the ordinary high-pressure engines. The Guibal Fan, now in operation at Pelton Colliery, at the Harvey air-pit, is 9 metres in diameter = 29·51 ft., and 3 metres in breadth = 9·837 ft.; it is driven at the rate of 60 strokes per minute on the average, by a direct-acting non-condensing engine, with 24-inch vertical cylinder, 2-feet stroke. From five experiments made with this fan in November 25, 1869, with the shutter in five different positions, it was found that with the shutter half closed the best result was obtained in quantity of air and height of water-gauge, with the shutter more open or more closed than that there was in each case a diminution in quantity of air. With the shutter half open the engine was indicated 21·59 lbs. per inch average pressure on the piston, the indicated horse-power at 60 strokes per minute was 67; the quantity of air obtained 107,520 cubic feet at a pressure of 2·6 on the water-gauge. This pressure gives to this quantity of air a power of 44 horse, and 65 per cent. of power realised by the machine.

The Waddell fan is placed over the Hutton seam air-pit; it is 30 ft. in diameter, formed with curved sides, central opening 14 ft., eight large blades and eight small intermediate blades. It is driven by a 24-in. horizontal non-condensing engine, 2-ft. stroke, direct-acting. At the rate of 68 revolutions the Waddell fan is said to give a result equal to the Guibal fan running at 60 revolutions per minute, under the same conditions. The two fans are applied alternately to produce the ventilation.

The coal produced at Pelton Colliery is a pure gas coal; it is conveyed by the Stanhope and Tyne Railway for exportation to the Continent; for gas making this coal has been appreciated ever since the opening of the colliery, 34 years ago.

THE EXPORT COAL TRADE.—The exports of coal from the United Kingdom amounted in August to 1,132,804 tons, as compared with 1,081,326 tons in August, 1869, and 1,058,952 tons in August, 1868. The exports to France in August were 228,274 tons, against 164,266 tons and 147,058 tons respectively. The shipments of coal to Russia presented a considerable increase in August, but they almost ceased to Prussia in consequence of the blockade established in that month by the French as regards the North German ports. In the eight months ending Aug. 31 this year coal was exported from the United Kingdom to the aggregate extent of 7,713,916 tons, as compared with 6,921,922 tons in the corresponding period of 1869, and 7,302,983 tons in the corresponding period of 1868. The exports to France were 1,626,114 tons, 1,333,063 tons, and 1,281,382 tons respectively. The exports of coal have increased this year to Russia (considerably), Sweden, Holland, France, Spain, Italy, the United States, and Brazil; but they have decreased to Denmark, Prussia, the Hanse Towns, and India. The value of the coal exported in August was 552,950*l.*, against 520,590*l.* in August, 1869, and 513,374*l.* in August, 1868; and in the eight months ending Aug. 31 this year 3,664,495*l.*, as compared with 3,306,514*l.* in the corresponding period of 1869, and 3,610,807*l.* in the corresponding period of 1868.

ASSESSMENT, AND RATING.

RE MESSRS. VIVIAN'S APPEAL.

SIR,—Your comments on this case, a few weeks since, and the highly important consideration involved in the whole question of rating, render it very desirable that in all questions of this character the data, or "truths admitted," be correctly stated, and that the matter should be approached in a reasoning, impartial, and conciliatory spirit. The plain facts of the case are these:—

In 1868, the parochial assessor was requested by the assessment committee to re-value Messrs. Vivian's works, which had continued to be assessed upon the old valuation made in 1863. This he proceeded to do, estimating to the best of his judgment the "net annual value," of the different works, that is to say—"Of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes, and tithe commutation rent charge, if any, and deducting therefrom the probable average annual cost of repairs, insurance, and other expenses, if any, necessary to maintain them in a state to command such rent." (See 6 and 7 Will. IV., c. 96.) And in making his valuation he did not take the "cost of the works," or "very large trade profits," as essential elements of calculation, but based it solely on what he considered to be the fair annual rental value of the furnaces, buildings, machinery, &c., forming the several works.

This valuation the Messrs. Vivian disputed, and finally appealed against in June, 1870; and professional valuers were called in by the parochial authorities to make a detailed valuation of the works, to ascertain whether their assessor's valuation could be sustained. The valuation and report of these gentlemen showed that they could not support the assessment by 1144*l.*, and on receipt of this valuation the assessment committee offered Messrs. Vivian to reduce their valuation by 1100*l.*, "but the offer was declined," and even a much larger deduction, "not even 2000*l.*, would be agreed to" by the appellants. The case, therefore, came on for hearing, and after the appellants' case had occupied the Court for three days a compromise was effected, whereby a deduction of 1400*l.* was agreed upon, instead of 1100*l.* offered to the appellants previous to trial. The practical result being as set forth in the following table:—

Description of property rated.	Rateable value.			
	Old assessment of 1863.	New assessment of 1868.	Professional valuer's assessment.	Assessment agreed upon.
1.—Copper works, &c.	£1088 10 0	£1982 10 0	£1528 10 0	£1530 0 0
2.—Rolling-mills, &c.	688 10 0	1360 0 0	1237 10 0	1231 0 0
3.—Nailery	—	80 0 0	63 10 0	65 0 0
4.—Silver works, &c.	607 10 0	1415 10 0	1173 0 0	910 0 0
5.—Sulphuric acid works	—	792 0 0	657 10 0	660 0 0
6.—Phosphate works	—	426 0 0	345 0 0	350 0 0
7.—Nickel and cobalt works..	391 11 0	610 10 0	517 10 0	520 0 0
Totals	£2776 1 0	£6666 10 0	£5522 10 0	£5266 0 0
8.—Foundry	135 0 0	192 0 0		
9.—Canal basin, &c.	—	65 10 0		
Totals	£2911 0 0	£6924 0 0		

The appeals against 8 and 9 were withdrawn a few days before the hearing. The Assessment Committee, in the published report of the minutes of their last meeting, say—"We have supported the assessment at the amount at which the valuers called in by us to support the original valuation (1868) valued the works, with the exception of 300*l.* (should be 256*l.* 10s.); this arose from there being great doubt as to certain tubs in the silver works being ratable."

The *respondents' case did not come before the Court*, as the compromise was effected before the learned counsel had opened their case. Your assumptions, therefore, that "in the first place they considered that the cost of the works should form an essential element in their calculations; and, secondly, they took it for granted that there were very large trade profits, and these were accordingly taken into consideration," are, to say the least, somewhat premature. I heard the case throughout, and never once heard the "'gentlemen of the long robe,' or the parochial officials, contend that the value of the works, and the trade profits, are the data for the assessment." "The special Court of Quarter Sessions for the county of Glamorgan have, however, *not* decided to the contrary," in this case at all events, for the simple reason that the Court was not asked to decide anything, but merely to ratify the compromise that was effected, and say where the costs should lie.

In respect to your remarks upon the propriety of re-assessing such works oftener than every "five or seven years," the parochial authorities would naturally not incur the expense of a new valuation unless they had good reason to suppose it was necessary from the altered condition and value of the hereditaments. In works of this character extensive alterations and additions are constantly going on, new inventions and new scientific combinations are frequently taking the place of old processes, *and materially altering* "the net annual value," or "the rent at which the same might reasonably be expected to let from year to year," after deducting all statutables, and consequently it is only reasonable and just that the assessment should from time to time be adjusted in accordance with such annual value."

The force of this is particularly shown in Messrs. Vivian's case, where the assessments of 1863 have been so very materially and properly increased, and to adopt five or seven years, or any other period, during which no alteration of assessment should take place, would

be arbitrary and unjust. The overseers not only "have the right to open the question," or to re-assess the works every year, but it is incumbent upon them, and is their bounden duty, to "revise" all assessments in each year that do not correctly show the full annual ratable value :" 25 and 26 Vic., c. 103, sect. 14, says—"And unless such overseers think that the valuation then last acted upon in assessing the rate for the relief of the poor correctly shows the full amount ratable value of all such hereditaments, they *shall* revise such valuation." At the same time, it cannot be doubted that it would be most unwise, for many reasons, to disturb an assessment without good and sufficient reason.

In respect to the more important question, as to the principles of assessment and rating that you advocate, I purpose next week, with your permission, to show that the views you inculcate are not strictly in accordance, and in part even opposed, to the law, which you say is "most explicit," in the data upon which such properties should be assessed, and also to touch upon "Reader's" letter, and your remarks in last week's Journal, on colliery rating. M.E. AND C.E.

Swansea, Oct. 3.

ON BOILER EXPLOSIONS.

Sir,—I would, with your permission, briefly call attention to the fact, which appears to be rather curious, that a great majority of boilers—that is, plain cylindrical boilers—that have exploded have been 6 ft. and upwards in diameter. I think it will be found that this is a very frequent occurrence; and, if so, may these explosions, as a rule, not be due simply to over pressure? that is, the boiler becomes gradually weaker, owing to age and constant tension unequal to the weight put upon it, and explodes. If we take a boiler 30 ft. by 6 ft. we have about 77,760 square inches, and if 35 lbs. pressure is applied the total weight of the boiler is 1215 tons. Now, the difference between the strength of this boiler and one 5 ft. in diameter is enormous, and yet on the boiler 5 ft. in diameter, which has, or ought to have, not more than about 40 lbs. per square inch applied, we have as under:—Total square inches, 04·800, at 40 lbs. per inch; total weight, 1157 tons.

Engineers give for a 5-ft. boiler, ⅜-in. plate, a theoretical pressure of 250 lbs. per square inch, and for a boiler 6 ft. in diameter 208 lbs. That is the breaking strain, but this, it must be borne in mind, is for new plates, and great deductions must be made for old plates. Nothing more has transpired respecting the late severe boiler explosion at Walker, and it is very unfortunate that the man Robson, who had charge of the boiler, and who was expected to be examined at the adjourned inquest, to be held shortly, has died.

It is to be hoped that the experiments which are being conducted by Mr. Waller, the engineer for the Midland Steam-Boiler Insurance Company, will throw some light on this very mysterious and important subject. It is understood that he is, in accordance with the instructions of the jury in this case, making experiments to ascertain the strength of the plate which was actually in use at the time this boiler exploded. It would be well if experiments could be made to ascertain the breaking strain of boiler-plates of good quality, (say) after working 5 years, 10 years, 15 years, and 20 years. There would be no difficulty whatever in getting iron of the requisite age to be used in conducting the experiments, and thus some sort of idea or guide might be constructed when it is shown in what ratio this kind of iron really deteriorates by working, being exposed to fire, and often great changes in temperature, as well as constant strain. It would also be well to look closely after the pressure applied to boilers, as it is pretty clear that in some cases brought prominently forward lately there has been no want of water, and no glaring defect visible in the construction.—*Newcastle, Oct.* 4. M. E.

PREVENTION OF COLLIERY ACCIDENTS—No. V.

Sir,—My last letter upon this subject appeared in the Supplement to the Journal of June 4. Other important subjects have taken up my attention in the meantime, or I would sooner have continued it.

I concluded my last communication with a description of the various safety-cages and disconnecting links in use at collieries. I have just one or two other apparatus of the same class which have lately come under my notice to describe before leaving this part of the subject. Mr. J. King, of Pinton, Derbyshire, has patented a Safety Link and cage, which demand some attention. The link is, in many respects, similar to that patented by Ormerod, described in my last letter, and acts in precisely the same way. The safety apparatus attached to the cage is exceedingly effective and original—it is intended to be used with round wire conductors. On the top of the Cage there are four brackets, one at each corner, carrying two shafts with levers. There are four vertical levers, to which the lifting-chains are attached, and four inclined levers, with their ends resting on the shoes, or eyes, of the cage, which work or slide over the wire conductors. In the ends of the four last-mentioned levers there are holes, and through these the wire conductors travel. In case of the winding-rope breaking or the cage becoming detached, the vertical levers fall back, and the inclined ones are drawn up so as to bind the conductors. This action is brought about by means of flat pieces of spring steel, which have their one end fastened to the top of the cage by means of nuts and bolts, and the other attached by a small chain to levers on the two shafts. While the cage is hanging all right to the rope these springs are kept in tension, but on the cage being loosed they fly to their place on the top of the cage, and bring the inclined levers into the position before mentioned, thus holding the cage safely and securely. This appliance is very simple, and, comparatively speaking, inexpensive. I understand that Mr. King has also an arrangement for wood conductors, which is both simple and effective. I saw some weeks back in Belgium an apparatus which I believe to be the best in existence for holding a detached cage, as it combined the whole of the requisites necessary for such an appliance—it was simple, strong, not likely to get out of repair, and quick in its action. It consisted of two very strong shafts, fixed in brackets to the top of the cage. At the ends of these shafts were claws keyed on. In the centre of the top of the cage, between the two shafts, there was a large spring, similar to those used for railway carriages, only, of course, not so large. The ends of this spring were connected to the two shafts by means of levers, and through the centre of the spring was a pin, attached by a chain to the dee-link at the end of the winding-rope. On the cage being lifted the spring was drawn in tension, operating on the shafts, and thus keeping the claws clear of the wood conductors, so that the cage could travel either up or down. In case of the cage becoming disconnected the spring would fly to its natural position, and send the claws into the wood conductors. This apparatus was geared to a cage carrying six wrought-iron tubs, which, when loaded, made the total weight about 6 tons. The cage was of very large dimensions, being 16 ft. deep, by 10 ft. broad, and worked in six conductors—the claws took effect in case of accident on the outside four.

I have long since left the subject as to the best boilers and mountings to be used, but, as explosions have lately been so prevalent, I will again revert to it, and notice two inventions that are of the utmost importance to all users of steam-power. The first one I would draw attention to is the Ashcroft Patent Low-Water Detector and Alarm. It is superior to other water indicators, in that it is without valves, springs, cranks, floats, or, in fact, any movable mechanism, so that it is free from the fault of sticking caused by corrosion, expansion, or the binding of any of the parts. This instrument consists of a piece of 1-in. diameter iron gas-tube, an air-chamber of iron, and a disc of metal about 1 in. diameter, fusible at 212°, or in boiling water, which is screwed to its seat by an union, having a whistle on its stem, a vertical pipe, which reaches to about the height of the top of the boiler. The union also connects the detector to the boiler. The action of this instrument is as follows:—After the boiler has been put into operation the steam forces the water into the pipe, and the air therein into the air-chamber; the compressed air is, in a few hours, absorbed by the water in the pipe and boiler. No circulation of water can take place in the pipe as long as its end is under water; therefore, the metal disc will keep firm and solid, the temperature of the water in the pipe never rising above 140°. When the water in the boiler gets dangerously low the end of the detector pipe is exposed to the steam, which rushes in, and softens or melts the metal plug or disc, and blows it through the stem into the air, and the whistle immediately acts, giving notice to all around that the water is low. The detector is so constructed with a lock-up cock that the whistle can only be stopped by the manager, or whoever may keep the key. This instrument depends solely upon the laws of gravitation and heat for its operation, and is as good as any indicator invented for giving notice of low water.

Another first-class invention is the patent Safety-Valve, of Mr. T. Adams, jun., Ancoats, Manchester. This valve possesses the following properties:—Under no conditions whatever of the fire can a single ounce of pressure be generated within the boiler above that at which the valve is loaded to blow off, and the valve will return to its seat without lowering the pressure within the boiler more than 2 lbs. under that at which it is loaded. It will rise, relieve the boiler, and return to its seat within the space of 30 seconds, no matter how fierce the fire may be, and there is little or no probability of it sticking. There is a lock-up arrangement which places the valve beyond the reach or power of any engine-driver tampering with it. The valve is simple in its construction, and consists of a brass circular valve and seat fixed in the bottom of a cast-iron dome. A wrought-iron rod, round which is a spiral spring, is fixed to the top of the brass valve. A thread is cut in the top of the dome and fitted with a brass nut, which is screwed down to adjust the spring to the required pressure. A cover is placed over the dome and screwed down with set pins, the heads of which are covered with a cap, kept in its place by a padlock. The steam escapes through a circuitous passage, terminating at the side of the cast-iron dome. From what I have seen of this safety-valve, I am sure that it is the most perfect in use, and that where it is used it is next to impossible for the boiler to burst from over pressure, or pressure greater than that due to the load placed on the safety-valve. Were this valve and the low-water detector generally used we should have far fewer boiler explosions. I will leave the rest of my subject for a future letter, which will be the concluding one of the series. COLLIERY ENGINEER.

Dudley, Oct. 4.

MINING MACHINERY: TRANSFER OF POWER—No. IV.

FOWLER'S CLIP-PULLEY.

Sir,—The clip-pulley is now extensively employed in transferring power from fixed and portable machinery. The pulley itself consists of a series of jaws, set close on the periphery of a wheel, so as to form a complete groove. A wire-rope works in this grooving, and as each pair of clips successively pass under the point where the pressure of the rope commences, the latter is gripped and retained throughout a half revolution of the wheel. The amount of grip is in all cases proportionate to the strain upon the rope. In order to work ropes of different diameters with the same pulley it is only necessary to shift the clips, which can be readily effected. One practical advantage resulting from the working of clip-pulleys is that the rope is subjected to a continual pressure upon its sides, thereby preserving its true form. The following particulars will in some measure show the applicability of the clip-pulley to mining purposes. In collieries underground pumps are driven distant more than 1000 yards from the engine. At iron mines inclines varying in length from 700 to 1200 yards are worked. At some of our colonial mines power is transferred from Cornish winding-engines for driving incline planes and dressing machinery. The speed of the clip-pulley ranges from three to seven miles per hour, hence it follows that its proper relation is with slow speed motors. By combining the clip-pulley with a water-wheel or Cornish rotary-engine power may be readily transferred for winding and dressing purposes, but any system of wheels and ropes is not well adapted for transmitting power through tortuous workings; this can best be effected by means of small pipes, in combination with hydraulic-rams or a weighted plunger. X.

THE METALS AND THEIR ORES—GOLD—No. XIII.

Sir,—Gold is a most widely diffused metal, and is to be found in quantities more or less abundant in all the countries of the globe. In the present and following papers I shall endeavour more particularly to point out those regions in which the precious metal is found in appreciable or remunerative quantities, and where gold mining is or has been carried out systematically as an important branch of industry. From the most ancient periods gold has been highly prized and eagerly sought after by man, and it may reasonably be inferred that, found as it is in its native state, the beautiful yellow colour of gold would be the attraction which would first lead to its being observed, whilst its useful properties of malleability, ductility, softness, and unchangeableness, &c., by enabling it to be easily manipulated by the imperfect tools of the most primitive people, would in other respects enhance its usefulness, and cause it to be the earliest metal known or searched for. Gold is first alluded to historically in connection with the river Pison, probably the Euphrates, "which encompasseth the whole land of Havilah, where there is gold, and the gold of that land is good." Job tells us that "the earth hath dust of gold;" and that gold was very early sought after for purposes of ornamentation is proved by the fact that Rebeckah was presented with golden earrings and bracelets, no unworthy gift even to a lady of our day. We also read that King Solomon's navy, supplied by Hiram with Phœnician mariners, brought from Ophir, which is supposed to have been situated on that part of the African coast opposite to Madagascar, 420 talents of gold, and in one year Solomon collected 666 talents, or about 27 tons in weight of gold. The quantity of gold collected by this King must have been very great, as even silver "was nothing accounted of in the days of Solomon," being but as the stones in Jerusalem. From Diodorus we gather that Semiramis, the founder of Babylon, erected in that city three statues of gold, one of which was 40 ft. high, and weighed 1000 talents, and that he brought together gold amounting in value to 11 millions sterling of our money. The same historian tells us the tomb of King Simandius was encircled with gold 1½ ft. in thickness, and 350 cubits in extent. Again, Darius, King of Persia, received from his provinces tribute in gold amounting to 3½ millions. Crœsus, King of Lydia, who lived 540 years before Christ, has become proverbial for his golden treasures. Herodotus relates that in return for the hospitable kindness towards some of the subjects of Crœsus on the part of the family of the Alcmaeonidae, at Athens, a member of that family was invited to visit Crœsus, who, on his arrival, presented him with as much gold as he could carry away. To improve the opportunity Alcmaeon, "providing himself with a large tunic, in which were many folds, and with the most capacious buskins he could procure, he followed his guide to the royal treasury, there, rolling himself among the golden ingots, he first stuffed his buskins as full of gold as he possibly could. He then filled all the folds of his robe, his hair, and even his mouth with gold dust. This done, with extreme difficulty he staggered from the place, from his swelling mouth and projections all around him resembling anything rather than a man." This apparent greediness does not appear to have troubled the wealthy Crœsus in the least, for "when he saw him he burst into laughter, and not only suffered him to carry away all he had got, but added to it other presents equally valuable." We are not surprised when we read further on that after this the family of Alcmaeon became exceedingly affluent. Pytheus appears to have been another most enterprising gold miner, as at one period he caused the whole of his subjects and slaves to mine for this metal; but subsequently, partly from the intercessions of his wife, seconded by a famine in his kingdom, brought about by his absorbing greed after gold, he limited the number of miners to one-sixth of his subjects. Pytheus, at the time he entertained Xerxes and his whole army, was possessed of nearly four millions sterling in value of metallic treasure.

The Egyptians obtained immense quantities of gold from Nubia, Ethiopia, and the Sahara Mountains, and it has been calculated that these mines alone yielded annually to the Pharohs at least 6,000,000*l.* sterling, chiefly from gold. One more fact, demonstrative of the wonderful results at times attending mining operations. The Athenians derived their wealth chiefly from the mines of Attica, Thrace, the Island of Thasus, Scaptesyle, and Thessaly. The Romans at one period were possessed of an enormous amount of gold, obtained from their mines in Illyria, and various provinces of Italy and Spain, besides which a large influx was received by them from other gold-producing countries of the world. In the year 14 there was 358,000,000*l.* sterling in value of the precious metals in the Roman empire, but the mines of Illyria and Spain, after a time, fell off, and as the yield of gold could not keep pace with the extravagance of the Romans, the State gradually became impoverished to such a degree that eventually there was less than 34,000,000*l.* in the whole empire.

In my next paper to the Journal I shall resume the subject by describing some of those discoveries of gold which approach, and are more closely connected with, our own times. E. GLEDHILL.

Mining Offices, Shrewsbury, Oct. 3.

UTILISATION OF BLAST-FURNACE SLAGS.

Sir,—It is repeatedly stated in the Journal that the refuse slag from blast-furnaces is capable of utilisation in a variety of ways, and that its application is all that is wanted; yet I see no effort being made to bring it into the market, nor to lessen the inconvenience arising from its constant accumulation about the works. Perhaps you will permit me to suggest what I believe to be a few of the causes which may account for this state of things. Firstly, I think the public know too little about the slag to be induced to adopt it; and, secondly, I think the experiments which have been made with slag, although, perhaps, of the utmost scientific value, have been of only little practical utility. I am not aware that any experiments have been made to ascertain the weight per square inch required to crush slag. In fact, when there is no trouble taken to keep it free from air-bubbles such tests would be of little value, as the strength would depend as much on the solidity as upon the composition of the slag. For this reason the same care should be taken in casting slag as in casting metals at present considered marketable.

Practically speaking, the slags appear to be the molten flux combined with the impurities that have been taken up from the metalliferous ore in course of smelting, and when the slags run pretty free from air bubbles they seem quite as dense as flint. As to colour, the blacks, greens, and greys are the most common, and sometimes the variations are really beautiful, but no one seems to have studied the question of the production of these colours, so that no attempt has been made to improve them in this respect. Now, I should think it might be tried whether something brighter than the ordinary slags could not be got by the admixture with them of various materials as they flow into the mould (for I suppose they would be moulded to make them marketable). This admixture could, perhaps, be best made by throwing in the colouring matter in fine powder. This would be quickly molten, and thus would marble the slag without trouble. I would suggest that the cyanides of potassium, and some of the salts of copper, which could be obtained in a cheap form in the slags from copper furnaces, should be tried. We know that the presence of boracic acid gives a reddish surface to the slag, and when the black comes through in some parts, as it often does, a very fine red and green marble is the result. Now, it would do much to facilitate the introduction of slags if it were stated at what price columns of 8 ft., 9 ft., and 10 ft. respectively, and of 9 in. and 1 ft. in diameter, could be delivered in London.

The slag being at present worse than worthless, there would merely be the cost of moulding and the cost of carriage, with the addition, of course, of a certain amount for profit. Now, as a rule, the granite pillars used so much in the construction of modern buildings are employed solely for ornamental purposes, and not for supporting the edifice, so that slag, if equally beautiful and but one-half the price, would be sure to replace the more expensive article. Yet, even as to strength, I believe slag would stand quite as great a crushing weight as bricks; and, if so, even the commonest slags could be turned to good account in building. It frequently happens that the healthfulness of dwellings is much lessened by the dampness which rises through the brickwork, and if good slag blocks, (say) 20-in. cubes, could be supplied at a low rate, which should not be more than 2s. each, there could be little doubt that they would be largely used by builders. These blocks, which would be quite impermeable, will stand so as to be about 8 in. below and 12 in. above the surface level, and rest upon a good bed of concrete prepared to receive them.

The appearance of these footings would be an improvement to the building, and would render any inconvenience from damp impossible. It is thought that if a slower process of cooling were adopted slag could be made less brittle, and, consequently, more valuable, whilst no additional cost would be incurred in preparing it for market. In conclusion, I may observe that where it is desired to produce ornamental designs in slag, I think the cost would be reduced to a minimum by having a reverberatory furnace near and below the level of the blast-furnace, the reveberatory furnace being so arranged as to facilitate running the liquid slag into suitable moulds.

Newport, Oct. 3. PUDDLER.

PRODUCTS OF MINING REPRESENTED AT THE RUSSIAN INDUSTRIAL EXHIBITION AT ST. PETERSBURG—No. II.

The Bogolslovsky district of the Administration of Government Mines, in the province of Perm, exhibits auriferous sands and specimens of cinnabar found in the diggings.

The Miassk gold diggings, in the Government of Orenburg, Troitsky circle, send to the Exhibition specimens of sands containing gold, and of the bed of the channels after different stages of washing, from the mines of Mundanaefsk, Verkhne, and Nijni Miassk Andrayefsk. The obtaining of gold commenced in the year 1822, and the production is from 45 to 50 poods yearly. The working capital employed is from 480,000 rs. to 500,000 rs. The gold-washing machinery, on Mr. Komarnitsky's system, is brought into action by portable steam-engines, and the miners, &c., employed number 2000.

Platina is sometimes met with in conjunction with gold on the Ural, and the sands of the Nije-Tagile Mines, belonging to Mr. Demidof, contain it in large proportions. That gentleman exhibits specimens of sands containing platina, gold, and conglomerates of platina; also a large lump of native platina, weighing 1 lb. 73·96. Specimens of this kind, however, have been found weighing 10, 19, and 20 lbs.

The Imperial mint at St. Petersburg exhibits a fine collection of samples of raw platina, and spongy platina in the same metal in a forged state, besides specimens of iridium, ruthenium, osmium, rhodium, and palladium, the produce of the Urals and Siberia. Then follow articles manufactured of the forged metal, such as dishes, crucibles, wire, retorts, &c., all manufactured at the mine, and of excellent workmanship.

It should be remarked that the Government is the sole wholesale dealer in platina, and the latter is only obtainable on presenting a petition to the Master of the Mint. About 30 years ago a platina currency was introduced in Russia, but the expenses of production were found to militate against its regular adoption, and all the coin issued has been called in.

Siberia, or the trans-Uralian provinces, are very rich in metals. There are three extensive mining districts. The most westerly comprised the mines of the eastern declivities of the Ural Mountains where they occur between 56° and 60° N. lat., occupying a tract of about 40 miles in width. The second mining district is that of Barnaool, in the Altai Mountains. The third is that of Nerchinsk.

The gold mines of Siberia, or, rather, auriferous sands from which the gold is procured by washing, discovered since 1829, extend along the whole northern declivity of the mountains that bound Siberia on the south, from the Ob to beyond Nerchinsk, especially on the eastern side of the Kuznetsk range, which extends on the eastern side of the Altai to Sandypshoy northward, past Kuznetsk, to the Kija, in the tract between the upper Tom and the upper Tschulym, on the Yenissey, near Minusinsk and Abakansk, thence eastwards to the Kam and the Birussa, and along the whole upper course of these tributaries of the Yenissey; further on, to the south-west side of Lake Baikal, and of the Angara, which issues from it, as also on the east side of the Jablonoi Chrebet, in the valley of the Shilka, above and below Nerchinsk. Now, as gold is found as well to the west of the Ural Mountains, towards Perm, and at Udskoi, near the Sea of Ochotsk, in the North Pacific, we see that an auriferous zone, though interrupted here and there, included between 50° and 60° N. lat., traverses the whole of the ancient continent, in a line which is one-half longer than the greatest breadth of Africa.

Notwithstanding the apparent advantages of an enormous supply of precious metal, gold mining as an industry has been for some years on the decline in Siberia, particularly in the most extensive region known as the northern and southern systems of the Yenissey, owing to a variety of causes, among which are mentioned the bad harvests which have prevailed for a succession of seasons, and the consequent high prices of provisions with which the mine proprietors are bound to supply the miners, whom they employ by contract for the summer season. Another cause, the most potent of all, is the

high tax which is imposed by the Government for the privilege of working the mines. In fact, so unprofitable has this industry become of late that some of the largest and oldest firms have discontinued operations. It should be the object of the Government to encourage as much as possible this enterprise, considering its vast importance as the means of supplying a fund for the paper currency of the State,* which is very extensive. It affords employment for tens of thousands of workmen, inhabitants of Siberia, has already contributed to the extension of trade in general, and to the steam navigation of the Siberian rivers in particular. The taxes or royalties paid to the Government, as estimated by Mr. Latkin, who is a large mine proprietor, are divided into three categories or classes. According to the first, up to 2 poods (76 lbs. English) weight of pure gold obtained, 5·18 per cent., which, with other additional expenses, amounts in all to 8½ per cent. According to the second category, from 2 to 5 poods (76 lbs. to 180 lbs. each), 10 per cent., which, with extra expenses, amounts to 14 per cent. According to the third category, from 5 poods and upwards, the taxes, with additional expenses, amount in the aggregate to 19¾ per cent. The effect of such enormous imposts is self-evident. It should be observed, however, that this short-sighted policy has been acknowledged in a measure by the Government, and the question of reducing the royalties has been for some time on the tapis. There can be no doubt that a more liberal view will be taken of the question, with the examples of Australia and California before them, the more so as reforms have been introduced into nearly all the departments of the national economy.

Mr. Latkin remarks that the smaller royalty, although still heavy, has been the means of increasing the number of small enterprises; this, he says, is particularly noticeable in the southern system, where, notwithstanding the exhaustion of rich mines, there is comparatively a considerable influx of gold seekers. For small undertakings there is a large field open in the circles of Mareensk, Achinsk, Minousinsk, Kansk, and even Yenisseisk itself, where innumerable rivulets, containing rather limited proportions of gold, from 1 6 z. to 2 4 z. (from 000,64 to 000,96 of a kilogramme) in the 100 poods of alluvial soil, remain undisturbed, representing so much dead capital. In the Yenisseisk district even, which has been constantly worked, according to Mr. Latkin, there are scores of places containing gold in the proportion of 2 4 z. to 3 0 z., and even 4 0 z. (from 000,120 to 000,160 of a kilogramme) to the 100 poods, which, owing to the high duties, have remained unworked. It should be observed that out of 518 mines opened up during 24 years, from 1840 to 1864, in the northern system were actually worked during the whole period only 132 large and small, and in the southern system for the same number of years out of 542 mines were worked only 123; this state of things being solely accounted for by the burden of taxation. It is said that with a more liberal policy even the diggings that have been abandoned could be worked over again, as sufficient gold can be found in the layers under the vegetable soil, and on the sides of the workings, to remunerate the undertaking.

Silver is found to accompany the gold of Siberia to the extent of from 6 to 8 per cent., copper also to some extent, and lead likewise in small quantities. It is calculated that about 50,000,000 poods of sands and alluvial soil is washed annually in the Siberian mines, the latter process being conducted on the American principle, followed by that of amalgamation. The washing of gold is brought to great perfection, the loss not exceeding 2 z. to 4 z. (000,8 to 000,16 of a kilogramme) in the 100 poods of sand.

Mr. Latkin gives the following returns of the amount of gold obtained during six years in the northern and southern systems of the Yenissey, and the numbers of mines and miners employed:—

IN THE NORTHERN SYSTEM.

1861,	number of diggings	36,	gold obtained	398	poods,	number of miners	9,975
1862,	,,	39,	,,	376	,,	,,	11,780
1863,	,,	53,	,,	394	,,	,,	9,270
1864,	,,	55,	,,	349	,,	,,	10,995
1865,	,,	50,	,,	349	,,	,,	9,000
1866,	,,	50,	,,	342	,,	,,	8,700
Total	....			2208	poods		59,720

IN THE SOUTHERN SYSTEM.

1861,	number of diggings	40,	gold obtained	207	poods,	number of miners	6,400
1862,	,,	40,	,,	182	,,	,,	6,860
1863,	,,	54,	,,	163	,,	,,	5,100
1864,	,,	46,	,,	150	,,	,,	5,000
1865,	,,	48,	,,	138	,,	,,	4,800
1866,	,,	50,	,,	140	,,	,,	5,200
Total	....			982	poods		33,360

For the whole of this period the average annual yield of gold for the northern system was 368 poods; for the southern, 163⅔ poods: and in the general aggregate, 3 4-10ths poods to every 100 miners for the summer months (in the winter all operations cease). All the gold obtained in the Yenissey district in its degree of purity is in most cases represented by the fractions 86-96ths, and rising gradually to 92-96ths; the average may be taken at 89-96ths, of which standard the cost of a pood of gold would be 12,500 rs. According to the first category, the aggregate yearly value of gold obtained during six years in the Yenissey district was 2,425,000 rs., the amount of taxes representing a yearly payment of 206,125 rs. According to the second category, the annual value was 1,876,000 rs., which paid in royalties yearly 262,500 rs. According to the third category, the value of the gold obtained was 2,350,000 rs., on which the taxes were 462,000 rs. for the same period.

There are two exhibitors at the Exhibition of native gold. The cabinet of His Imperial Majesty shows a specimen nugget weighing 15 lbs. 42 z. (about 14 lbs. English) obtained from the Altai district. Mr. Koozneтsof exhibits a nugget weighing 5 lbs. 36 z. (about 4½ lbs. English). These are, however, small samples when compared with others discovered some time ago. Thus in 1825 there were found 25 lumps of pure gold, weighing together 2 poods 26 lbs. (95 lbs. English); one of these was 14 lbs. weight. Afterwards a lump weighing 24 lbs. was found, and on Sept. 7, 1847, a nugget weighing 87 lbs. was discovered.

When a sufficient quantity of gold is obtained it is sent to Barnaool to be purified, from whence it is afterwards conveyed to the Imperial Mint, at St. Petersburg. The latter establishment exhibits a fine collection of specimens, showing the process of purifying the metal and the coining of money. Gold coin is produced yearly at the Imperial Mint to the value of 19¼ million roubles, and of silver money little short of 6 millions. The gold pieces, however, are seldom seen in circulation in Russia, they are the half imperial (normal value 5 rs. 16 cop.), and the ducat (normal value 2 rs. 95 cop.) The standard for articles manufactured of gold is 89·96, and for silver 84·96.

The machinery in the Imperial Mint is principally of English make. This establishment was for years under the superintendence of an Englishman, General Armstrong, who was Master of the Mint.

Last year new gold deposits were said to have been discovered about 300 versts distant from Yenisseisk. They are situated in the country watered by the Angara River. Auriferous deposits have also been discovered in the North Pacific, on the island of Ascold, a dependency of the maritime province of Siberia.

The silver of Russia is derived principally from the silver-lead ores obtained from the Kolivan Mountains, which constitute a part of the Altais. The principal mines are—1, that of Syranow, on the southern banks of the Buhtarma, about 40 miles from the Irtish, and not far from the boundary of the Chinese Empire; 2, the mines of Riddersk and Krukow, on the banks of the Ulba, which joins the Irtish between Bukhtarma and Ulba; 3, the mines of Semenof, further to the north-east, on the lower ridges of the range; 4, the mines of Schlangenberg, famous for the great quantity of silver which, in the last century, was got from them. At present their produce is less considerable, and they begin to be exhausted. Copper is also found in many of the above mines. The mines of Kolivan are said to employ nearly 40,000 persons (without reckoning the peasantry of the adjoining districts, who pay their poll-tax in wood and charcoal), in bringing the materials to the smelting works, which have been erected at Novopavlofsk and Susunk, in the neighbourhood of forests, as there is little wood near the spot. At Susunk the ore is smelted and purified. When the silver obtained comes to St. Petersburg it is smelted again in the Imperial laboratory, and it yields 3 per cent. of gold. Still more to the eastward, in the province of Dauria, between the rivers Shilka and Argoon, are the mines of Nerchinsk; these were opened in 1704. They are celebrated for their production of silver-gold ores, of which there are some fine specimens shown at the Exhibition by the Cabinet of his Imperial Majesty. One exhibitor shows also specimens of silver-lead ores, obtained in the Semipalatinsk territory of the Kirghize Steppe; and another, samples of silver glance, obtained in the Miussk circle of the country of the Don Cossacks—a fresh source. Although the quantity of lead obtained from all the above mines is considerable, large quantities are still imported from England, the duty being nominal, yet the following returns of the importation from this country would tend to prove that the thousands of tons of lead which were formerly left on the spot after the silver had been extracted, on account of the dearness of transport, are now being made use of. The value of the imports of lead from Great Britain was as follows:—In 1856, 835,000 rs.; 1857, 763,000 rs.; 1858, 555,000 rs.; 1859, 852,000 rs.; 1860, 670,000 rs.; 1861, 775,000 rs.; 1862, 727,000 rs.; 1863, 598,000 rs.; and 1864, 232,000 rs. The importation of foreign lead does not increase in proportion to the demand for the article.

* On January 1, 1860, the paper money in circulation amounted to 679,877,853 silver roubles, and the reserve fund to 96,241,818 silver roubles, of which only 86,870,014 silver roubles were in specie.

Of tin there is only one exhibitor, who sends specimens of ores obtained in Finland, in the circle of Serdobol. The latter commodity is principally imported from this country. In 1812, in the south-easternmost part of Siberia, in the mountains of Dauria, bordering on the Gobi, rich tin deposits were found, but there is no evidence that they have been worked to any great extent. The mountains of Dauria contain beryls, topazes, emeralds, and other stones of value. In the Baikal Mountains lapis lazuli of fine quality is found. The Altai Mountains produce a variety of hard stones, which are found in enormous layers, such as jasper, mingled with pieces of chalcedony, cornelian, &c. Here should be noticed the extensive polishing works of Kolivan, of the Altai district, belonging to the Cabinet of his Imperial Majesty, which send to the Exhibition a variety of articles, among which are conspicuous vases of violet-grey porphyry, and a chimney-piece of green wavy jasper, valued at 10,759 rs.

The Ekaterinburg polishing works, also belonging to the Emperor, exhibit, amongst many other valuable ornaments, a large oval vase of cornelian, valued at 37,873 rs., and another of jasper, valued at 5250 rs. The articles manufactured of rock crystal, obtained in Siberia, are very numerous, amongst which a bust of the late President Lincoln is conspicuous; it is priced at 300 rs. Amythists and topazes are also displayed manufactured into a variety of articles, as well as lapis lazuli. A spendid specimen is shown of aquamarina from the trans-Baikal, valued at 2500 rs.

In the present Exhibition a new feature presents itself in the mining department—a complete view of the coal mining industry of Russia. There has been recently considerable activity shown in the researches instituted for coal, particularly since the extension of railways has caused an increased demand for fuel, which wood alone cannot advantageously supply. In my last article I alluded to the South of Russia, the country of the Don Cossacks, as the chief source for coal. The administration of this province has sent to the Exhibition samples (119 in all) of common coal and anthracites, of excellent quality, obtained from the Donetz ridge, the western part of which is the most prolific in that mineral. The Russian Navigation and Trading Company, who have their seat at Odessa, exhibit anthracites obtained from their mines near Novocherkask, the depth at which they are worked being 63 sajens (441 feet). Other districts of Russia, which were considered not many years ago to be destitute of coal, are also represented at the Exhibition. The Muraevni Coal Mining Company, in the Government of Riazan, exhibit samples of a description of Boghead coal. The beds were discovered last year, but they are now only commenced to be worked. The price of the coal is given at 30 cop. per pood (50s. per ton). The Malevsky Mines, in the Government of Tula, Bogorodinsky circle, exhibited a specimen lump of coal, weighing 70 poods (1 ton 2 cwts. 2 qrts.), at 4 cop. per pood (6s. 7d. per ton). The produce of the latter mines during five months and a half in which they are worked is 1,500,000 poods, of the value of 35,000 to 40,000 rs. The number of miners employed is 150, and the coal is raised by means of an 8-horse power steam-engine and wire-rope. The ventilation the mine is effected with two fans, worked by a 10-horse power portable engine. Another exhibitor, from the same Government, sends samples of coal obtained at a place called Skooratovo, at 7 cop. per pood (12s. per ton). The mine was open this year, and 5000 poods of coal have been obtained from three shafts, supplied principally to the Moscow-Koursk Railway.

The Jurofsky Mines, in the Government of Kief, in the circle of Chigirinsk, exhibit specimens of lignite coal, which has recently been discovered. Poland has long been celebrated for coal, particularly the western district in the Government or Petrokofsk. Specimens of this mineral are seen at the Exhibition from the latter country, obtained from the Grodzetsk mines, where eight seams are worked, in thickness from 24 in. to 8 ft., at a depth of from 35 to 265 ft.

Coal has also been discovered in Siberia. Specimens of coal are exhibited obtained in the Steppe of the Siberian Kirghizes, in the Akmolinsk territory. The beds are composed of seams 6 ft. thick, at a depth of 119 ft., which increased to 24 ft., with an incline of 12°. The Ural also sends samples.

From the Altai district there are likewise specimens of coal and coke; and, lastly, the extreme North-East of European Russia also contributes samples of coal from the banks of the River Oussa, an effluent of the Petchora.

In view of the enormous importance of coal mining in Russia, the Imperial Government is endeavouring by every means to encourage the prosecution of this industry. Thus in the neighbourhood of the Groushefsky Mines, near Novocherkask, the capital of the Don country, a sort of mining colony is being established. The Government grants allotments of land, and free use of building materials for constructing habitations to anyone desirous of entering this community of miners, with various other privileges, to induce the formation of a permanent settlement. Some large orders have already been taken by owners of mines in the South. Last year the Navigation and Trading Company undertook to supply the Government lines with 2,000,000 poods of anthracite, at 25 cop. per pood. The company is constructing a whole fleet of steam lighters for service in the rivers and ports of the Black Sea.

Plumbago is an article which is now obtained in large quantities in Russia; it is found in Siberia, on the banks of the Ob, and Mount Batagoul, near Irkutsk, is particularly celebrated for that mineral. At the Exhibition there are shown samples of plumbago obtained from the extreme north of European Russia, the Toorokhan district, and from the North of Finland crucibles are exhibited manufactured of this plumbago, which have withstood the test of melting steel.

Another new industry is represented at the Exhibition in connection with mineral produce—the manufacture of paraffin, &c., which bids fair to become an important item in the economy of the country. The peninsula of Abcheran, in the Caspian Sea, in the neighbourhood of Baku, has long been celebrated for its mud volcanoes and fountains of petroleum and naphtha, which are drawn from the wells in enormous quantities. The soil round Baku has also this singular property, that on digging up two or three inches of the surface, and applying a light, the part which is so uncovered immediately takes fire. If a cane, or tube even of paper, be set about ten inches into the ground, confined and closed with the earth below, and a light be applied at the top, a flame immediately issues, and will continue to burn. This method the inhabitants use for lighting their houses, which have only the earth for the floor. This peculiarity has been taken advantage of by the Trans-Caspian Trading Company, established in the Government of Baku. The distilling of the naphtha is effected in 22 stills, which are heated all the year round with the gas exuding from the earth. The product obtained is a kind of paraffin, called photonaphthil, which is of the yearly value of 660,000 rs. The crude naphtha is purchased in the immediate neighbourhood, to the extent of 375,000 poods annually. A large collection of samples are shown at the Exhibition.

The Kuban district of the Black Sea has lately also acquired celebrity for its mineral oil springs, particularly at a place called Taman, where Mr. Novosiltsof, has the lease of several wells. The oil was first struck about five years ago, when as much as 6000 vedros [1 vedro =2¾ imperial gallons] were obtained daily; but owing to the lack of a sufficient supply of casks and cisterns, the greater portion was wasted. In 1867, when Mr. Novosiltsof took matters in hand, another well was sunk, when the naphtha forced itself upwards, in a jet 4 in. in diameter, to a height of 40 feet, yielding over 6000 vedros in 24 hours. Since then other wells have been sunk, and complete works established by the above gentleman, for distilling and rectifying the naphtha, the machinery and apparatus having been supplied by an English firm. Mr. Novosiltsof sends to the Exhibition samples of crude naphtha, at 1½ cop. per lb. (5*l.* per ton); mineral oil and photogene, at 8 cop. per lb.; petroleum, at 10 cop. and 12 cop. per lb.; legronine, at 10 cop. per lb.; gazoline, at 12 cop. per lb.; and heavy oil, at 4 cop. per lb. The distilling is effected by means of superheated steam, in 10 stills, of a capacity of 1500 vedros each.

Salt is another mineral of vast importance to Russia, both as an article of consumption and as a medium for supplying a vast income to the State from its taxation. Notwithstanding the large quantities of salt which are yearly exported from this country to Russia, the latter State abounds in that mineral, and it is only the difficulty and expense of transport, which would raise the price of the commodity to an enormous extent, that precludes the total exclusion of the foreign article. Salt in Russia is principally obtained from its innumerable salt lakes and springs, situated both in Europe and in Asia; they are called Samosadochniya, or self precipitating lakes, those in the Government of Astrakhan being most celebrated, and the salt of which both the Caspian shore and these lakes afford inexhaustible quantities, and of superior quality, is perhaps the most valuable commodity which this province possesses. The bottom of these sheets of water, which yield millions of poods annually, is one mass of crystallised salt. Rock salt is also found in this Government. Tchipchachi is a perfect mountain of salt, and the summit of Bogdo-oola is crowned by a hill composed entirely of the valuable material.

The Ural also possesses mines of rock-salt, that of Iletsk, in the Government of Orenburg, being most celebrated. The salt trade being a Government monopoly in Russia, the commodity produced by private individuals is subject to an excise duty about equal to the amount of duty levied on foreign salt, 38½ cop. per pood (3s. 2d. per cwt.) There are exceptions in favour of a few mines and lakes, where the duty is much less, owing to local conditions.

The Astrakhan Administration of Salt Lake Mines exhibits salt in its natural state and purified, from ten lakes; also samples of rock-salt from Mount Tchipchachi. The province of Astrakhan obtains from its varions sources 4,000,000 poods of salt yearly, in the preparation of which 2000 workmen are employed.

There are two private exhibitors—Count Shoovalof, of the Government of Perm, Solikam circle, who exhibits common salt, duty paid, at 42 cop. per pood, and table salt at 2 rs. and 3 rs. 20 cop. per pood The works of Osoye and Lemva were established in the years 1606, 1610. The yearly production is 2,000,000 poods, of the value of 900,000 rs. The salt is obtained by boiling the brine, which is pumped up out of the mine by steam-power. The bed of salt lies at a depth of from 210 to 700 ft.; the number of workmen employed is 600. The other exhibitor is Prince Galitzin, whose works are situated in the same neighbourhood, and are of the same kind. The quantity of salt obtained annually is 1,600,000 poods, of the value of 675,000 rs

JAMES RUSHFORTH.

THE GREAT WESTERN SHIP CANAL.

SIR,—Perceiving several references in the Journal to a proposition for a Ship Canal from Bridgewater to Exmouth, but not stating the exact route that it will be carried, or the distance, which it appears cannot be less than 64 miles, I beg to say that there was a canal formerly opened from Bridgewater to Tiverton, Devon, a portion of which has been lately taken for a station on the Bristol and Exeter Railway; and I have no doubt another portion may be selected to join the said canal to the present terminus at Tiverton, and then by tunnel under Exeter Hill (similar to the Regent's Canal under Primrose Hill) may be carried on by the side of the River Exe to the final station at Exmouth. As I know no other preferable route for the said canal, I sincerely trust my propositions may be approved of and adopted without further delay. G. B. (A Tivertonian).

London, Oct. 5.

MINING ENTERPRISE.

SIR,—It is some time since I asked the privilege to call public attention to mines and mining through your columns. I will now, with your permission, make a few observations. I have frequently stated in my letters to the Journal the opinion that, taking all considerations into account, there was no description of investment, of at all a speculative nature, so deserving of confidence as mines. Statistics have from time to time been published in those letters furnishing irrefragable proof of that position. It is to-day as it used to be; a comparative view of the most popular forms of investment, such as railways, banks, assurance offices, and with mines of all description—tin, copper, lead, silver-lead, iron, coal, &c.—and in whatever part of the British Isles they may be situated, will show that mining investments have been more remunerative and more stable. This may be accounted for in several ways. Metals are always in request, not always, of course, in the same degree, nor all equally so at a given time, and sometimes the supply may be more than the demand, causing slackness to ensue, but, as a rule, all the metals are wanted, whatever the condition of a country may be. War will shut up banks and close financial companies. The railways of a country may be torn up by invading armies or by internal revolution, as we see in the one case in France now, and as was so lately so in the United States of North America during the civil war between North and South. A run of accidents may deprive assurance or telegraph companies of their profits, but mining is not exposed to such contingencies. Accidents do occur of an expensive nature to the proprietors, as well as fearful to the sufferers, in coal mines, but in metallic mines (so to designate them) there is exemption from such dissasters to those who work in them, and from such expense to the proprietors.

In a period of peace the first branch of business which shows resuscitation is the metal trade, for no other business can be conducted without the use of metals, and in most trades very largely. Our ships are built of iron, instead of wood. Our ships, timber built, are sheathed with copper. The fittings of vessels are in a large proportion brass, zinc, and tin. Our ships of war are either iron or iron cased, and the guns are of iron, bronze, or steel; the arms and even the ammunition are metallic. The railways are laid with iron or steel rails; the locomotives require half-a-dozen different metals or metallic combinations for their constituents. An assurance company cannot build a fire-engine without metals. Our chief financial operations are conducted by the use of bullion. We do not wear an article that can be manufactured without the use of several mineral productions. The food we eat can neither be taken from the earth nor cooked without implements and utensils for which the makers are dependent upon the miner. The pen by which this letter is written is steel, the ink-bottle an amalgam, and the pen-rester bronze. The fact is we can see no operation of life in which metal is not a *sine qua non*; and we can enjoy nothing in life which it is not an essential requisite for the production. The safe in the office behind me as I write is iron; my paper box is tin, and everything around me has either some metallic substance entering into its composition or could not have been here if metals were not used to produce the material of which it is constituted and to fasten it for use. The trade in metals lies at the basis of all other trades. It is the grand requisite of civilisation. Without the work of the miner the lamp of progress must go out; science can use the microscope and telescope no more; agriculture no more plant, or reap, or mow. In a word, without metals all other material, how useful soever with them, become wholly inutile.

From these facts it is plain that the trade of the miner can never fail. Whoever invests in mines places his money in a business which will not, cannot die out. While the world lasts capital must be invested in mining, and mining must be profitable. The question may be fairly asked, where are there such profits made as in mines? Many of your readers will easily recognise that this is plainly proclaimed in the history of the Devon Great Consols; the Great Laxey, in the Isle of Man; the Van, in South Wales; the Providence, in Cornwall; and these are a mere sample of a great number of successful adventures. Many instances have occurred in which the investor has in a few years realised the whole of his investment, and received for the remainder of his life a large income annually or half-yearly in the shape of dividends.

Under circumstances like these how absurd the mania for sinking capital in foreign loans. How often have they beggared the investor?

What is the value of French Rentes to-day, lately so popular? Who would now lend Austria, Spain, or Portugal money? Men are willing to buy Turkish stock, but now that France is prostrated who will unite with Great Britain to protect the shores of the Dardanelles from the Cossack? I venture to say that there is scarcely a safe national loan in Europe unless in our own country, or in America, except the United States of the North. Besides, is it nothing as to how money invested is employed? That which is put into a good prospective mine encourages British industry; that which goes into foreign exchequers is wasted in wars, or in foreign court extravagance, and, in many cases, even in debauch.

Let us, then, turn to British mining, and look at its advantages, and use them. Take, as an instance, Rose and Chiverton United. This is one of the most secure and encouraging mining properties extant. It belongs to a good class of wealth-producing metallic properties, being silver-lead. The lodes are in a new piece of ground parallel to the site of the old East Rose, which revealed the most precious deposits of lead ever known in the south-west, or perhaps anywhere else. A gentleman who lately visited it, a man of experience in mines and metals, used this remarkable language—"In all my experience I never met a better piece of mining property. I can hardly call it a speculation; it is a first-rate investment." The shares will, doubtless, attain a very high price. In future correspondence I will name other properties deserving the notice of investors. JOHN B. REYNOLDS.

MINING AS AN INVESTMENT.

SIR,—In many of my former letters I called your attention to the fact, so little understood, but so important, especially to ironmasters, that mining enterprises offer a better scope for capital than any other whatever. In time of war most mineral productions are in great requisition—iron, its product steel, lead, and bullion chiefly so. Coal, a mineral but not metallic substance, is also under such circumstances in vast request, for steam fleets and transports, and for the foundries and factories where weapons of war are manufactured. Tin and copper are extensively required in military operations, for camps and canteen purposes, and accoutrements. So that war, the terrible extinguisher of all other industrial operations, is not so unfavourable to mining.

In peace no industry can prosper without favourably affecting the mining interest. The cotton trade is one of our greatest, if not the greatest, branch of English trade. If it be busy, mills must be kept in working order, and many more, perhaps, built. No one can visit a Manchester weaving or spinning manufactory without being struck with the vast amount of metals used in them. Steam-engines, furnace, spindles, cranks, cranes, hauling machines, and various small but important and numerous portions of the loom apparatus are composed of metals. If a visit be paid to the broad cloth manufactures and worsted mills of Leeds, Huddersfield, Bradford, Halifax, &c., a similar impression will be made. In Nottingham and Leicester the same is the case in greater degree. In Sheffield a vast population live by working up the metals into cutlery, files, saws, and various other tools. Birmingham wants the metals for its bronzes, gun-barrels, brass foundries, &c.; and all the iron districts want iron for rails, locomotives, and all those things which are made up of steel, brass, zinc, tin, copper, and lead.

Our commerce is dependent upon our trade in metals. A ship is never launched without metal making, moving, and fitting her up.

A new soil is never broken but by the use of metals. A mine itself, whether the rough gold diggings of distant lands or the deep tin, copper, iron and coal mines of our own, cannot be opened without metals obtained from some other mines are brought into use.

Science is dependent upon the use of metals. A microscope, telescope, stereoscope, or, in fact, any scientific instrument, cannot be brought into use but by metals, of which they are largely composed, and without the instrumentality of which they cannot be prepared. Indeed, it is to the knowledge which science has obtained of metals that we are indebted for modern acquisitions in the philosophy of stellar phenomena. We have been able to discover that in the photosphere of the sun there is a vast mass of incandescent metals, corresponding to such as are found upon this earth. The same experiments extended to other systems reveal that these stars or suns, which

"In lone and distant glory burn,"

have photospheres consisting, at least in part, of metals smouldering in intense heat. So that wherever we turn, and in whatever direction our investigations are pursued, we find that metals constitute a *sine quâ non* in the providence of worlds, and in the political economy of all the nations and regions of our own planet. Indeed, one can hardly look upon an object without perceiving not only that it was fashioned by metals, but that in some degree it consists of them. The fishing hook, the spinster's needle, the pin, the pen, the boat-hook, the roasting-jack, the grate, the furnace, the steam-engine, the man-of-war built of metal and armed with metal, the vast suspension bridges and railways of modern times, all exemplify the universality of the use of metals.

The employment of metals can never cease while civilisation exists; whoever, therefore, invests in mining has the satisfaction to know that he is not sinking his capital in a perishable pursuit, but in one which must last, and which so enters into every other that it is the very salt of all industrial life.

Mining must not be confounded with jobbing in mining shares. In real mining investment there is no "bulling" and "bearing." Shares may go up or go down, the property represented is not improved or deteriorated by this "duck and drake" process. If the shares command a premium, no matter how vast, on the Mining or Stock Exchange, the mine itself will be no better for it. The true plan for the investor is to embark in a good prospective mine, having taken sound council beforehand where he can rely upon the judgment of his counsellor; and let him stick to it, and see that it is adequately wrought out, and pay no attention as to whether it is or is not quoted in the markets, or whether it is "bulled" or "beared" in Finch-lane, Threadneedle-street, or Throgmorton-street.

The advantage of such a prudent course is obvious, if men will only consider the ruinous state of foreign loans. Russia is arming against Turkey, and the stocks of both nations must go down. The French Rentes, the other day so eagerly sought, are nowhere. Belgium, Luxembourgh, and Holland all expect to be swallowed up by Germany. The Mahomedan nations, borrowers from England, are perishing from lack of people. The South American States, our debtors, are struggling against anarchy and revolution. England and her colonies offer the safest roads for investment, and in no respect more than in their mining resources. I will in a future letter enter more fully into this subject. THOS. SPARGO.

Gresham House.

MINING IN WHITE PINE, NEVADA, U.S.

SIR,—I beg to hand you herewith a few particulars of White Pine district, Nevada, which will, doubtless, be of considerable interest to many of your readers.

White Pine district was first discovered in 1865. Detached fragments of ore, or "float rock," were found from the crest of White Pine Mountain, down to its base on both sides or slopes; but few veins, however, were then discovered, and none of these were at that time further developed than by a few days' work on each claim, as required by the mining law. The ores contained a great deal of what the miners call "base metal," by which they mean all ores containing either sulphides, oxides, or carbonates of iron, zinc, lead, or antimony. These cannot be worked by common mill process, and, consequently, these mines laid undisturbed for a few years, until the discovery of Eberhardt, Hidden Treasure, Aurora, and a few rich free metal mines in 1868, when crowds rushed in the district; and as all could not get an Aurora or an Eberhardt, many turned their attention to White Pine Mountain, and named it the Base Metal Range. Hundreds of mines were discovered and located. The principal mines consisted of carbonate of lead ore, yielding by smelting process 40 to 60 per cent. of lead, and \$15 (3*l.*) to \$60 (12*l.*) of silver; other ores mixed with copper were better, some as rich as \$500 (100*l.*) per ton of silver, and large quantities of \$50 (10*l.*) to \$100 (20*l.*) of silver.

In the winter of 1869-70 the indications were such as to warrant the erection of several smelting works, and the first erected was a small upright cupola, built of common country rock, lined with sandstone, a fan driven by horse-power furnishing the blast. Several tons of ore were smelted, when the fan burst, and the horses ran away. A second attempt was attended with more success, as shortly after starting the roof of the building took fire, and the concern was burnt down. Shortly after the works known as the White Pine Smelting Works were erected; these works have proved a practical success, and a benefit to the miners, as large quantities of ore have been purchased and reduced by them. In November, 1869, the Magary Works were constructed, and they made the most successful short run that has been accomplished in the district. The works were fixed up in the winter, and turned out about 30 tons of metal in six days, without injury to any part of the cupola or lining. The run was made simply as an experiment or test of the capacity of a small furnace, it being but 28 by 32 inches in the clear. The company owned a large quantity of mining ground, and intended by working the mines in connection with the smelting business to reduce the cost of ore from \$5 to \$10 per ton. These works and mines are now owned by the Hamilton Mining and Smelting Company.

Probably these works are more desirably located than any in the district, being at the base of the mountain, where all the ores and charcoal can be delivered free of tolls, and without hauling up, or over any steep grades. The company own 10 acres of land, with free water, and the works are situated on the road leading from Hamilton, and all the mining districts surrounding to the Pacific Railway. The smelting interest is in its infancy; thousands of claims, opened sufficiently to show ore, can be worked at a profit, *if there is a ready, cash demand for the product.* The work is simple, and returns are large. The latest enterprise of the kind is just in successful operation, and will be, when finished, the largest undertaking of the kind on the Pacific coast. The Rothchild Smelting Works is under charge of Governor Matheson, of Illinois. The ore consumed will be principally from the South Range, while the Hamilton Smelting Works will develope all the north and west side of the mountain.

While these works are going on the mills and free metal mines are in a most flourishing condition. The Eberhardt and Aurora Company (Limited) are just starting work vigorously; a new mill of large capacity will soon be completed, and a wire tramway from the mines to the mill will reduce the cost of transporting ore to a nominal figure, from \$3 to about 50 cents. The Aurora Sink, Hidden Treasure, Imperial, Silver Wave, Borril, and others, are all in fine condition, and the prospects of the district, as a whole, are very flattering.

If capitalists can come and examine the inducements offered the product of silver would be immense. We are poor; money is worth at the Bank 3 per cent. per month. This work cannot be carried on without the expenditure of means for works, transportation, and subsistence.

A case of samples is just being shipped by me to London, collected from fifty of the mines of the Base Metal Range, showing the different character and quality of the ores, and the peculiarity of all is that they carry lead in sufficient quantity for fluxing; in fact, for the business of smelting White Pine seems particularly well adapted. Charcoal is made in great abundance, wood sells at \$5 (1*l.*) a cord, delivered in town. The teams which bring supplies, machinery, &c., from the railway load with bullion as "back freight" at a nominal price. Cheap living and a healthy climate add to the inducements offered for an abundant supply of labour. The valleys surrounding these mountains are unsurpassed in productiveness, and for stock raising are equal to the best in California.

White Pine, Sept. 14. A RESIDENT.

THE BODMIN TIN DISTRICT.

SIR,—Anyone who is well acquainted with this district, not a mere promoter of mining companies, would confer a favour on myself and, no doubt, many other adventurers in tin mines by giving the names of such mines as have paid dividends during the last twenty years, giving the dates and amounts paid. By the Bodmin tin district I mean the country lying between Liskeard and St. Columb, including the parishes of Bodmin, Roche, Lanivet, St. Neot, &c., but *not* the St. Austell and Par districts. About twenty years ago a large number of tin mines were started in those localities, all promising early dividends, and all coming to grief without paying a single one. As I suffered in pocket myself, I have carefully watched the numerous mines since and lately started in the same district, and have never seen one in the Dividend List of the *Mining Journal*. Of course, I am open to correction if wrong. I have been told there is plenty of tin, but so widely disseminated in lodes of great thickness that it never can pay without a very high price for tin, and being treated in immense quantities. Hoping these enquiries will elicit useful information from persons of repute, I subscribe myself— AN OLD ADVENTURER.

PROMISES IN MINE REPORTS.

SIR,—Three weeks ago a communication appeared in the Journal to the effect that in a fortnight from that time the dressing-floors at Pen'Allt Mine would be complete and in working order. Having upon the strength of some of the names connected with the direction, and particularly upon that of Mr. Fothergill, invested in this mine, I, of course, relied upon the announcement referred to that by that time there would be a termination to the suspense in which the shareholders have been kept, and that good results would soon be seen. Judge of my surprise when, on the lapse of the fortnight, I, on referring to the Journal of Sept. 24, found not a word either to say that the dressing-floors were complete, or in explanation why there were not. Judge further of my disappointment and vexation on receiving the Journal of this day to find again not a word about Pen'Allt Mine, in any shape or form. This is really trifling with the shareholders, and I think it incumbent that public attention should be called to this apparent breach of faith. I am not a miner, and, perhaps, am not doing what is the best; but this I know, that when I make a promise I am expected to keep it, or to give a reason why.—*Blackpool, Oct. 1.* OBSERVER.

[For remainder of Original Correspondence see to-day's Journal.]

THE SOUTH WALES INSTITUTE OF ENGINEERS.

A general meeting of this Institute was held at Cardiff, on Sept. 26. The newly-elected President, Mr. W. T. Lewis, Mardy, Aberdare, occupied the chair, and there were also present—Messrs. H. N. Maynard, W. Vivian, J. T. Edmonds, E. Daniel, W. L. Austin, J. R. Waddle, Matthew Truran, H. Jones, D. Davies, J. Simpson, L. Thomas Lewis, H. W. Martin, J. Llewellin, jun., J. Snape, B. H. Hill, T. Cadman, A. J. Howell, Leyson Morgan, G. J. Hewitt, T. Ellis, J. Murphy, D. Evans, T. G. Davies, Mark Lee, W. H. M. Phillips, W. Morgans, T. Coomber, H. Begg, T. Joseph, T. Curnew, J. Daniels, J. Kay, D. Morgan, J. P. Rae, D. Rees, R. Lonie, T. B. Wilmer, W. Thomas, jun., G. J. Snelus, A. Malo, M. Reynolds, J. Bates, J. McMurtrie, D. Thomas, J. Patrick, E. Richards, R. Bedlington, A. Basset, W. Adams, G. Wilkinson, J. T. Green, G. Brown, H. Huxham, E. Brigden, &c.

The minutes having been read, the appointment of officers was proceeded with. Mr. Cope Pearce and Mr. F. Brown were re-elected vice-presidents; Messrs. Wilkinson, E. Richards, and G. Brown re-elected members of council; Messrs. T. Joseph, H. Trump, and Jas. Murphy elected members of council; Messrs. Wilkins and Co. re-elected bankers; and Messrs. Cox and Brigden editorial and corresponding secretaries. Regret was expressed at the absence of Mr. Cox through severe illness. Messrs. T. D. Steel and Cope Pearce were re-appointed examiners of accounts, and Mr. M. Truran was appointed auditor.

Mr. G. Holmes, colliery manager, Blakeney, and Mr. Joseph Green, mineral agent, Pontypool Works, were admitted members.

THE PRESIDENT'S INAUGURAL ADDRESS.

The PRESIDENT stated that the present number of members was nearly 200, and after subscriptions now due were received there would be about 1000*l.* to credit. The majority of the members considered the proposition to erect a building, with museum, &c., premature. The waste of fuel in the generation of steam, the coal lost in working and left underground, coal-cutting machinery, and the enormous loss in small coal were in turn treated of, the loss from the latter cause being estimated at 8565*l.* per annum in a property working 300 tons per day. The various systems of underground haulage, ventilation of mines, the working of thin seams of coal, and the question of single and double shifts were likewise referred to; whilst, with regard to the future, it was suggested that the sinking and tubbing of shafts, the eastern and western portion of the mineral basin, and the causes of the changes in the quality of the various seams of coal from east to west, were subjects worthy of attention. In concluding his address, which contained a vast amount of valuable information, and was received most favourably by the meeting, he would only further suggest that important questions, requiring much time and consideration in experiments, the getting up of information and plans, &c., should be placed in the hands of committees of members of the Institute, in the same way as is practised in the North, and where, he was informed, it has proved highly satisfactory; and also that a list of subjects should be drawn up by the council of the Institute every year, upon which they should invite papers; and that premiums of books or medals should be awarded to the writers of the best papers. He asked their serious consideration to the several points worthy of attention; and if, during his term of office, they should be able to do something towards reducing the enormous losses caused by the present mode of working and treating their minerals, and secure their being worked and used in a more economical manner, with the least possible risk of life, he would not have occupied their time in vain, and the Institute would have conferred an additional boon upon the district, and fully realised some of its objects.

In the absence of the writer, the discussion on Mr. E. W. Richards's paper "On Bérard's Coal Washing Machine," already published, was adjourned.

The discussion of the papers by Mr. Alison and Mr. F. Williams, "On the Cleveland Ironstone," and the "Blast-Furnaces at the Cleveland Iron Works," which also have appeared, was likewise adjourned, a hope being expressed that the writers would be present at the next meeting, and that Mr. Whitwell would then be able to attend, the discussion of his paper, too, being postponed.

MINING SCHOOLS.

The next business was the discussion of the paper, previously read, from the pen of Mr. T. Coomber, "On Mining Schools." In the course of an elaborate paper, he said it must not be forgotten that most of the sciences which are applied to mining are also common to other industries, and that these other industries, of necessity, congregate in mining fields, such as chemical and machine-making factories. With very little additional expense the arrangements might be also adapted to the requirements of those to be engaged in these industries, with a consequent increase in the range of the constituency from which pupils would be drawn out of all proportion to the consequent increase of expense. There is much in the organisation of the new College of Science at Dublin that would be worthy of attention to this end.

Mr. R. BEDLINGTON enquired the course of instruction at the Bristol Mining School, and the class of persons who attended?

Mr. COOMBER said the school was worked in connection with the Trade School, and the object of the trade school was to educate young people who were to become connected with the industry of the country. No attempt was made to teach handicrafts, but attempt was made to teach sciences applying to handicrafts and industry. They had provision for making the English education of those who attended sound and perfect; and if a young man came to them, whose object it was to enter a mining institute, his wants were, of course, met if he were unprepared. But the characteristic of the school was the teaching of the sciences applying to technology. The basis of education was mathematics. Mathematics was applied to mechanics and machinery. They taught experimental physics, chemistry (organic and inorganic), prescriptive geometry, &c. In addition, for those engaged in mining, they had a course of lectures on mining technology, which Mr. Morgans, who had a paper to read that day, had charge of. Education in mining was not confined to the class-room, a considerable portion of the time of the student being occupied in the field in the practice of surveying, and in visiting collieries in the neighbourhood. He thought that shortly delineated the work they attempted to do. With regard to the class of young men attending, they drew their students from all classes. They had at the present moment the grandson of a former Prime Minister of the country, and they had also a man who had come from the North as a working collier. Between these two grades they had all classes. Mr. Morgans had conceived an idea as to the further development of mining organisation which was not touched upon in his (Mr. Coomber's) paper. Mr. Morgans thought it possible to carry on the technical education of the mining student, of which he had spoken, to a larger extent in connection with the practical education of the student. Mr. Morgans proposed to attempt a scheme devoting half the time of the student to the working and observation of mining pursuits. Mr. Morgans had the opportunity of introducing students to a small metalliferous mine in which he had interest. The scheme was quite new in connection with their mining education, but he believed it had been to some extent adopted in Frieberg. A portion of the student's time was engaged in the class-room, but a considerable portion was occupied in mining itself. Mr. Morgans intended to attempt a little more than was attempted at Frieberg, but probably upon that point Mr. Morgans himself would speak with more clearness and with greater usefulness.

Mr. MORGANS, jun., considered the great defect in the present system of mining education was a lack in the practical part. He thought most of the mining students who had passed through their training, when they were supposed to have finished, had too much of the character of "drawing-room" mechanics. Students required to have an intimate acquaintance with the essential elements of mining. There was no possibility of affording that information without having a mine in connection with the school itself, and allowing the student to devote a portion of his time to the actual use of his tools. It was with a view to the accomplishment of that object that they had opened the scheme to which Mr. Coomber had referred. His idea was that the defect of the present system of education would be met by some means of affording practical acquaintance with mining, which could only be adequately acquired by the actual use of tools.

Mr. VIVIAN, after expressing the interest with which he had read the paper, said Mr. Coomber was partly correct in speaking of the cause of the failure of the Cornish mining school as arising from the support given by men of influence rather than being pecuniarily supported by the pupils. But he thought much of the disfavour with which the school in Cornwall was viewed arose from ignorance. In a lengthy speech Mr. Vivian explained several local causes which, in his opinion, militated against the Institute, notably the selection of Truro for the school, which 18 or 20 years ago was not so much of a mining district. The speaker quoted the letter of a gentleman, in which the writer said, "I consider the cause of failure of the late Cornish Mining School was the want of a popular feeling in its favour at the commencement. Cornish mine agents generally have risen from the ranks, and the consideration of their success with the very limited education most of them had received was a great inducement for them to think that their sons should go and do likewise. Hence, many of them were unwilling to pay more than a few shillings a quarter for their sons' education—and, in fact, only a few of them had any idea of what the education was to be, or of what was its value. Again, I suppose the appointment of the teachers afforded a subject for dissent, and if the school had been established at Camborne instead of Truro those who spoke so disparagingly had, at least, one cause of dissatisfaction removed. Again, I believe there were other errors, which I will not now enlarge on. In my opinion, for a Mining School to prosper it must be popular among those for whom it is intended. There must be a feeling of need for the education offered, and a willingness on the part of the people to pay for it, if it cannot be otherwise obtained; and there must be a confidence in the teachers that they know their business, and are willing to labour for those requiring them." But since the failure of that school another attempt had been made in Cornwall, and though it had not flourished as might be wished it was doing a great deal of good. They employed a certificated teacher, and had some little assistance. But the mode of conducting the Institute was not so much like a school, but receiving men who had had a practical education in working in a mine—some miners' sons, and others educated young men who had had a preliminary education in the working of mines; 100 young men were under instruction, and of these 78 had passed an examination in one department or another—34 in mineralogy, 30 in chemistry, 5 in geology, and 9 in mining.

Mr. BEGG said he had had the privilege of being connected with a mining school, and the class of men attending ranged from working colliers to mining and civil engineers, and sons of colliery proprietors. The subjects taught included mechanical and other drawing, illustrative of mining engineering; the different methods of working coal and other minerals; the ventilation of mines; timbering and other measures of supporting roof; different methods of boring for mineral; sinking, holing, and tubbing of shafts, &c. In further remarks the speaker quoted Dr. Lyon Playfair as showing the necessity for mining schools of the character which had been indicated in the course of the discussion. He trusted the day was not far distant when they would not only have a mining school, but a school to give technical education to all interested in such an institute as theirs.

Mr. SNELUS expressed his surprise at the paucity of mining schools in Wales, and advocated their establishment. But he thought the schools should be taken to the men, and not the men to the schools. The difficulty was to begin. A certain amount of patronage should be bestowed on this kind of school, but his experience was that people valued that most for which they themselves paid; and for a school to be successful it must be supported more or less by the payment of the students themselves. As Mr. Coomber had said, he himself found all classes of persons attending their schools—both labouring men and the higher classes were interested in them. It seemed to him, in order to make science schools successful, employers should require young persons who are engaged at their works in any particular branch to have a certain technical knowledge of that branch before they started work—just as much as in many parts of England it was now required that they should have a knowledge of reading, writing, and arithmetic.

In reply to the President, Mr. SNELUS said he had found that the greatest element of success was the teacher himself.

Mr. MCMURTRIE referred to a custom in the North of England of taking young men of thorough education, and placing them under a practical colliery viewer. In no case could a mining school be made a substitute for a system of that kind. After the usual school a mining school was a useful adjunct, but they must teach practical mining as well. He did not think capitalists would be willing to take men from mining schools and give them important positions

they must first go to some colliery, and acquire that practical knowledge of details without which mining could not be carried on.

In answer to Mr. Coomber, Mr. MCMURTRIE said he meant that a mining school should be a connecting link between the ordinary school education and the education to be acquired at a colliery.

Mr. VIVIAN said, speaking from his experience, no man would in a metallic mine be employed as managér unless he had practical acquaintance with the working of a mine. He must be able to take off his jacket, and show the miners how to work underground.

Mr. COOMBER, in replying upon the discussion, said they might be astonished, but he had known young men, after studying at the school for a couple of years, appointed managers of mineral property; but, inasmuch as a mining school had demonstrated itself by experience adapted to introduce men to mining work, the necessity of practical training side by side with technical training had pressed itself upon them. He was not prepared to say what was the value of the training a young man got with a civil or mining engineer, but it seemed to him that Mr. Morgans' suggestion offered exactly the same kind of education that a young man would get with a mining engineer—a practical observation of the working of a mine, in addition to the technical education in which the right understanding of all operations of mining consisted. The speaker dissented from the view of some gentlemen that patronage was necessary for a mining school; he did not believe it, and he appealed to facts in his own experience in support of that opinion.

The PRESIDENT said, no doubt mining and scientific schools were productive of good, if the education were associated with actual practice in mining. Without that they simply gave a superficial education, which, when a man came into a responsible position, ended in simple failure. So far he thought such schools had been anything but successful for any length of time. The Glasgow and Bristol schools had been very flourishing at one time; but of late they had not been so well supported as they deserved. But he thought the matter was well worthy of their grave consideration.

Mr. COOMBER: May I interrupt you for a moment? Your remarks do not apply to the students? We have done without patronage.

The PRESIDENT: As far as Glasgow is concerned, I refer to the students as well.

On the motion of the PRESIDENT, seconded by Mr. BASSETT, a vote of thanks was accorded to Mr. Coomber for the paper which he had presented to the Institute.

NEATH MINERAL DISTRICT.

A paper on this subject, prepared by the President and Mr. Reynolds, was read, and the discussion adjourned, after a vote of thanks had been awarded to the writers.

MINE VENTILATION.

A voluminous paper, by Mr. Morgans, jun., "On Meteorological Influences on Mine Ventilation, and regarding Mining Ventilation," was taken as read, and the discussion adjourned.

The thanks of the meeting were given to Mr. Morgans, Mr. BEDLINGTON observing that it was a valuable production, judging from the glance he had been able to give the paper.

DIFFERENCES IN QUALITY OF COAL.

Mr. JOSEPH read a paper "On the Change in the Character of the Coal from Bituminous to Anthracite between Tredegar Iron Works and Venallt, in Glyn Meath.

A vote of thanks was accorded to Mr. Joseph.

The proceedings were brought to a close by a vote of thanks to the President for his occupancy of the chair, and his excellent address. Subsequently the members dined together at the Cardiff Arms Hotel.

A JOURNEY INTO SOME OF THE IRON-MAKING DISTRICTS OF THE CENTRAL PROVINCES OF INDIA.

BY MARK FRYAR, M.E., F.G.S.

Introduction.—In several places in India I had frequently met with iron slags and furnace cinders, evidences of the past existence of native smelting works, and often had I felt and expressed a wish that I might some day fall in with the native iron smelters at their work, but it was not until a short time ago that this wish was realised.

The Journey.—Leaving Chanda by the road to Moohl one has to pass through about as dense a jungle as Indian traveller ever meets with—a jungle growing out of the soils and clays of coal-bearing sandstones, or at any rate of sandstones beneath which other sandstones bearing coal seams occur. These sandstones continue for more than 20 miles eastwards from Chanda; and Mather and Platt's steam-boring machine, worked by Mr. W. P. Mather, is now steaming away in the jungle, for the purposes of ascertaining particulars as to the occurrence of coal seams below.

A Digression—The "Mayo Pit."—Chanda is not only the name of an Indian town in this part of the great empire, it is also the name of a large district in the Central Provinces, and since the discovery of coal by the indefatigable Deputy-Commissioner, Major C. B. Lucie Smith, it is also the name of a coal field. Westward from the town, and at a distance of about 15 miles, a pit has been sunk to coal; at about 80 ft. deep a Four-foot seam of good coal was passed through, and about 12 ft. below this a seam of upwards of 30 ft. in thickness has been penetrated. The Viceroy of India, Earl Mayo, descended this pit on March 1 last, and inaugurated Chanda coal mining by hewing a piece of coal from the large seam. His Excellency on returning to the surface graciously granted permission to name the pit "The Mayo Colliery," and a village near to the pit is to be henceforward known as Mayo Town. In referring to the coal and coal mining in this way, I have not made an unnecessary digression. I wish to inform my friends at home—the readers of the *Mining Journal*—how the coal and ironstones here are relatively situated, and to make the matter intelligible I give here a sketch map.

The Journey Again.—We started on our journey from Chanda to Moohl in an easterly course, Mr. Mather disturbing the stillness of the jungle by his steam-borer, was passed about three miles from Chanda, and the coal-bearing sandstone were left behind us at a distance of something over 20 miles. Associated with the coal measures sandstones there are bands of highly ferruginous rock, from some of which I fancy the native smelters have at one time taken iron, as furnace slags are met with near them. I hope to have a variety of them assayed for the metal, and some of them analysed with a view to their suitability as ores for reduction on a large scale. Here, too, as in many other parts of India, are the wonderful laterite beds, locally known as "mooruni." At Chanda itself, on the Moohl road from Chanda, and at the Mayo Colliery, to the west, these beds occur close to the surface; they vary in thickness from a few inches to may feet, and consist mainly of a coarse ferruginous gravel, which in Britain would doubtless be used as a source of iron. You will see from the map that our journey from Chanda is towards one of the great feeders of the River Godavery—the Weingunga; but some miles before coming to this we have left the coal field behind us, and are now in regions of metamorphic and gneissoze rock. Our route now, too, is more northerly than westerly. At the small village of Chicklee, on this, the western side of the Weingunga, the native iron smelting furnaces were for the first time seen; it was to me, as I have no doubt it would have been to most of the readers of the *Mining Journal*, a sight of great interest and curiosity. I had formed but a very imperfect notion of the mode of operation of iron smelting by Indiaus from what I had heard and read, and for the benefit of others who may have formed similar notions I shall make a description of the operation clear by a few illustrations. The simplicity of the mode is vastly amusing, and an old dusky son of Vulcan was very indignant at my enquiring if there was any other method employed for iron smelting than the one we were witnessing. His reply was, "What other way can there be?"

The Iron Smelting-Furnaces, and mode of Working them.—The furnaces are built of mud and stone, and their interior, or crucible, is repaired by mud and cow-dung after every "draw" of the metal.

The inside of the furnace is a truncated cone of about 14 inches in diameter at the base, and 4 inches at the top or truncation. The outside is from 5 feet to 6 feet in height, has a base of about 3 feet 6 inches in diameter, and slightly tapers towards the top. The blast is produced by one man working a pair of bellows, or by two men each working one large bellows. The small ones are simply goat skin-bags, made at one end to taper to a small burnt clay tuyere, and at the other provided with a pair of wooden lips, on which small straps are fixed for the operator's hand. In drawing the bellows out to fill with air the lips are kept open, then they are suddenly closed, and a skin-full of air forced into the furnace. As the right-hand bellows is pressed inwards to discharge its load of air into the furnace, the lips of the left-hand one are opened, and drawn outwards to receive its load, and *vice versa*. Thus as the hand holding one skin closes up the lips and presses inwards, the hand holding the other opens the lips and draws outwards, and by this means a continued blast is produced. The operation, simple as it seems, requires considerable practice before it can be done with the rapidity required. The blast for all the native smithies and forges is produced by the same means, and often one sees the wife or daughter working the skin for their relative "the village blacksmith." The iron ore is broken up into very small pieces preparatory to its reduction in the furnace, and after the furnace has been well heated, the ore and the charcoal are mixed together, in proportion by measure of about 1 of the former to 5 of the latter, and then poured into the furnace from the top. After blowing for about twelve hours, the skins and the wooden stool on which they rest are removed, the tuyere holes closed up, and the furnace tapped just below the tuyere holes to let off the slag. The mud and small stone wall forming the side of the crucible under the tuyere holes, is then removed so as to make an opening of about 1 ft. in area, and the metal, which now looks like a lump of cinder, is withdrawn by large tongs, and hammered, as it is being rolled about on the sun-hardened earth. After this operation is completed the mass, weighing from 20 lbs. to 25 lbs. is cut nearly into two parts by a common native hatchet, so as to show the quantity of utilisable iron it is likely to yield, and then it is ready for the market, so far as the smelter are concerned. Occasionally, when the proportion of cinders to metal is large, the mass is re-heated in a rudely-made hearth, and rolled and hammered as before. In this state it is bought by blacksmiths in the vicinity of the furnaces and forged into small bars, 6 to 8 in. length, and from 1½ to 2 square inches in cross section, and then sold at local fairs and bazars to the village smiths for making agricultural implements, cart-wheel tyres, the small hatchets for wood chopping which one sees on the shoulder of every native "clodhopper," and various other things of minor demand, as nails, spikes clasps, &c., used in native hut-building.

GOAT-SKIN BELLOWS.

W, wooden lips. S, body of bellows. T, earthen tuyere.

The Iron Ores.—From what has been said, it will be seen that no flux is used. The ore used in this part of India is a rich magnetic oxide, which on assay by the Government analysist in Bombay yields 68 per cent. of metallic iron, showing that there can only be from 4 to 5 per cent. of earthy matter to get rid of in the blast-furnace. Goonjwye is the first place come to in journeying from Chanda, where iron ore is being mined by the native smelters. Here shallow lodes are being dug at the foot of a hill, and the ore obtained in small fragments under from 2 to 3 ft. of surface earthy debris, and extending over a range of several hundred feet from the hill, and along one side of it. In ascending the hill from this range, and until reaching the top, a height of about 50 ft., and up a slope of more than three times this distance, I found that every piece of stone one could possibly pick up out of the thick jungle was a piece of highly magnetic iron ore. At the top of the hill the ore presents itself in huge blocks, lying in and on the edges of a natural quarry, one side of which consists of hard gneiss, and forms the hill flank opposite to the one, by which I ascended. From this quarry, or crater, one may reasonably surmise, has been forcibly expelled by volcanic blasting the fragments of ore now found at the base of the hill, and from which the native furnaces in the vicinity are supplied; and the wall of gneiss so well defined, and although seen for only a short distance owing to the jungle, indicates the presence of an iron ore lode.

Another Digression—"The Temple of Nature."—I must here say a word or two about the interest one cannot help feeling in a spot like this, apart from geological or mineralogical questions. Where the large blocks of ore and of gneiss are heterogeneously scattered, and Vulcan has himself mined or quarried on a scale far surpassing human efforts, an open space is formed, and is closely surrounded by trees, and these again filled in about their trunks with smaller jungle. It is to such places the native Koonbees and Gonds are drawn by sacred influences to perform their religious ceremonies, and at such places where, perforce, one feels as if in Nature's own cathedral. Here, for many a year, on the special annual feast day, must the native devotees have brought the image elephant, formed out of plastic clay and baked into hardness, and through this emblem of power worshipped the Deity, as many an image, perfect, and in various stages of decay, and the wreck of many more, are heaped together in front of the massive stones. And then, as in every such place where Nature's work has been done in a manner to attract imposingly, superstition, through long traditions, has peopled the spot with visitors from the dead, or from regions of inhabitants of habits and intelligence differing widely from those of earthly and human kind.

More Iron Ores.—Lohara is situated about 50 miles north-east from Chanda, and about 11 miles north by west from Goonjwye, and at this place, as at Goonjwye, there is a hill of the same kind of iron ore. For about 100 yards, through jungle, and on the slope of the hill from base to summit, one has to walk over fragments of magnetite; specimens of no other kind of rock can be found. The "expression" of the place, as regards the quantity of ore easily obtainable, seemed to me to excel that of Goonjwye. The natives dig for the ore here as at the other place, near the base of the hill, where they find it in small pieces, and thus save labour in breaking it up for smelting. In one place a sinking has been made to a depth of about 20 ft., on a kind of lode of the ore, and widened out into a large space, but this can only have been led to by finding small pieces in such places, as there is a vast quantity of the ore exposed at the surface in large pieces and masses. There is, I think, a probability that the ores here and at Goonjwye are elevated portions of one, and the same large lode; as at Dewalgaon, the third and last place I inspected, there is unmistakeably a lode of the same ore clearly traceable for at least 150 yards, and running nearly parallel with a line uniting Goonjwye and Lohara. The cardinal lode is about 10 ft. wide, and is filled up with nothing but massive ore; there are, however, forks and branches from this and small pieces of the ore are scattered over the country for many square acres in extent, as is shown by the various diggings for it for the native furnaces. This place is on the east side of the Weingunga river, and at least 30 miles further from Chanda coal field than Goonjwye or Lohara.

Concluding Remarks.—From the Mayo Colliery to Goonjwye, or to Lahara, the road is about 65 miles; the roads are good ones for native carts, that is as compared with Indian roads, and, save during the rains, the ores could be carted from the mines of iron to the present only mine of coal in the district for about 12s. per ton. To this sum would have to be added the cost of breaking up the ore at the mines, and filling it into carts, for which I think 2s. per ton would be sufficient. A very large quantity of ore is obtainable in fragments—many hundreds of tons—to load which into carts would not cost more than from 2d. to 3d. per ton, but for breaking up the large blocks drilling machinery and blasting by gunpowder would have to be resorted to, and would, of course, increase the cost. It is hoped that coal will be found nearer to this valuable ore than the Mayo pit, and then with narrow gauge and cheaply made railways, and Fairley's bogie-engine train, what may not be done in the way of economic transit of material. No one is more keenly alive to the importance of iron-producing works in India than His Excellency the present Viceroy—the Earl Mayo—and now that railway extension is to be made on a somewhat extensive scale, it is the flood tide of time "which if taken will lead on," &c., so far as regards iron works, and His Excellency the Viceroy is wishful to make rails in India for Indian railways, and other requisites in iron material, and why should they not be made, and made, too, in this part of India, when we have the best iron ore in the world, and a fair quality of coal so nearly together, and there, too, are limestone in abundance close at hand.

THE DISCOVERY OF GOLD IN NEW SOUTH WALES.

The reports from this colony are at present very pleasing as to the general prosperity, but especially as to the supply of native gold, and the discovery of fresh alluvial and fresh quartz deposits. As the Australian gold fields have up to this period yielded great productions, and are the object of profound interest to the empire and the world, it will be appropriate to glance at the history of the discovery in New South Wales, drawn from entirely original sources, and from the lips of not the reputed but the real discoverer himself, an account that has not been given to the public in any other form:—

"Gold was discovered in Australia by Mr. Barwise, in February, 1829. This gentleman was one of a firm of merchants in Sydney, who built the first store at the head of the navigation of Hunter's river, which founded the present town of Morpeth, and from which the up-country settlers were supplied with stores, for the payment of which their produce was taken. He was an enterprising man, fond of developing the resources of the country, and was intimately associated with the few talented men that the colony at that time possessed, who used to assemble at his house in George-street, Sydney, for friendly and scientific conversation. At one of these meetings a gentleman of great ability, and of retiring manners (Dr. Little), was introduced. The doctor had previously been on a pleasure exploration, for the purpose of informing himself as far as possible of the geology of that then new country, and had, at his own expense, made a tour into the Blue Mountain range, in a north-westerly direction from Paterson Plains, and, amongst other discoveries, found the evidences of a volcano that had been active at no very remotely distant period.

On the doctor's return to Sydney he kindly gave the public the benefit of his labours, and stated the above fact, which brought upon him an attack by the editor of the *Sydney Gazette*, which held up Dr. Little to ridicule as to the probable discovery of a recently active volcano in Australia.

It so occurred that Mr. Barwise had intended on his return to Wallis's Plains to make a tour to the north-west, for the purpose of endeavouring to find some river or internal water where stock could be driven for pasturage, as at that time there was a very severe drought, being the third dry season that had occurred, and as the place described by Dr. Little did not lie far off from the proposed track he had intended to have taken, he volunteered to alter his route, so that he could collect the evidence necessary to confirm the allegation made by the doctor.

Soon after the commencement of the year 1829 he proceeded to Wallis's Plains, and fitted out a small expedition, with drays to carry instruments, tools, stores, tents, and such things as were requisite for a journey into the wilderness, and started, steering in a direct course for Dr. Little's volcanic mountain, which in due time was found and examined, and specimens of cinder, pumice, and scoria enough to vindicate the character of the doctor were collected and packed on one of the drays. From this point a more northerly course was taken, where ironstone and carbonate of copper were met with of great apparent richness.

On the fifth morning after leaving Dr. Little's mountain, while the men were striking tents, the chief teamster, James Ryan, called Mr. Barwise's attention to a circumstance that he wished he would go and examine, which was some yellow metal that he had found while looking for the oxen that morning, which he had seen in a hollowed basin in a rock not far distant from their encampment, and which he could again find, as he had marked the trees, and in again going to which place would not delay the progress of the train, which would not be ready to start for some time. Accordingly, the 'blazed,' or marked, trees were followed, and the deposit was found. It was a water-worn basin-like hollow in a rock, and in it laid a quantity of bright yellow metal, glistening in the sun. Ryan had previously taken a little up in his hand, but had returned it to its former position. Both looked at it for sometime; at last Ryan said, 'What is it, master?' 'I don't know, Ryan,' was the reply, 'but we will take some of it with us at any event.' Not having anything to put it in, what was to be done? A happy thought suggested itself, and Mr. Barwise pulled off his jacket and shirt, and with his knife cut off the back and tail of that garment, forming it into a double fold, and put a quantity of the bright metal into it. They then retraced their steps to the encampment. This occurred in the middle of February, 1829, a few miles from the south bank of the Peel River."

The events of the further procedure of this journey are too lengthy for this notice, and, therefore, we will confine ourselves to gold alone.

"Rather more than two months after the above date Mr. Barwise returned to Sydney, and called his friends together, and showed the confirming facts connected with Dr. Little's discovery, the position of which the doctor had laid down very correctly (as be it known that travelling in an unexplored country requires even more accurate observation than travelling on the wide ocean); he also produced the samples of ironstone, copper ore, &c., reserving the gold for the last; and, after prefacing it with the story of Ryan, then introduced the tail of his own shirt, which had not been untied since the sample had been there deposited, and turning out the contents of the same on a sheet of white paper, and requested the company to inform him what that metal was. They none of them would allow that it was gold; one, in particular, said it was not mica, it was not copper, but it nevertheless was not gold; and they all declared that if Mr. Barwise insisted that it was gold, that he was a fit subject for the Paramatta Lunatic Asylum. After much discussion the yellow metal was poured into a tumbler, and set upon a side table, where it soon dwindled away, as every visitor who came to see it took a pinch of it. The fact was there was a general feeling amongst the sheep-farmers to suppress the discovery; and they all declared that if Mr. Barwise persisted in his gold theory he must be put in confinement,

as if their shepherds heard that gold was to be found in the mountains, they would all run away in search of it, and every sheep-farmer in the country would be ruined.

It may be asked, if Mr. Barwise was the discoverer of gold in Australia, how comes it that he did not claim the 2000*l.* awarded by the Government in 1852 to Mr. Hargreaves as the first discoverer? The answer is this, that the former gentleman was at that time in the southern part of California, and did not return to Europe till some time after the grant had been made, and the money paid by the Government, who were never known to pay twice."

The place where the gold was found is near the spot where the Peel River Company afterwards commenced their workings.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE LVIII.—In the last lecture I gave you (said Mr. SMYTH) a preliminary sketch of the arrangements made at the surface for the purpose of dressing the ores, pointing out especially the advantages of getting a proper site capable of extension, and along which the water may be made to act downwards on the material submitted to it, and a separation effected between that, fit for the smelter on the one hand and the refuse on the other. On the subject of refuse it is necessary to say a few words. There is often a portion of the attle, or deads, which contain a minute quantity of metallic mineral. If material of this kind contains pyrites, or other substances likely to injure the soil or vegetation, the question of what is to be done with it becomes very important. Again, it may exist in masses, when it is inconvenient or impossible to get rid of it for road-stone, and considerable expense must be incurred for the room taken up by the heaps of waste. Then there is that portion which goes into a fine powder, grit, or gravel, and is carried away by the water, creating a liability to silt up the natural water-courses, or in some places to poison the fish in rivers, or do injury to the cattle which graze on the banks of the streams. The difficulties of the miner in these respects are very much increased by what has gone on lately as to the conservancy of rivers and the preservation of fish, and, therefore, something must be done. To a certain extent it is impossible to prevent the fouling of the natural streams by what is carried down to them from mines, and if it is seen that hundreds and thousands of tons of refuse which runs down to the rivers can be kept back without any great injury to anyone the mine manager must take steps accordingly, or he will have complaints against him, if not legal proceedings and injunctions, which may greatly impede his work. In laying out dressing-floors points of this sort require much consideration, and must be decided by local circumstances.

I have hitherto considered these works as having the advantage of plenty of water to turn water-wheels, turbines, and other appliances, and for washing down the materials from one apparatus to another, trusting to their different specific gravity to separate them; but what is to be done when we can get no water at all? There are districts which are practically rainless, and yet of great mining importance. On the western side of the Andes, at some places in Africa, where there have been considerable mines of copper opened for a long time, and in Spain there are several regions notable in this respect. For instance, in the Sierra de Gador, a mountainous range from 4000 to 6000 ft. above the level of the sea, there is an extraordinary group of lead mines, which a few years ago went near to upset all the lead trade of this country, on account of the exceeding richness of the ores, which required no trouble either in raising or dressing, but where there is no water even for drinking but what is carried thither on mules backs, and where the power employed is solely that of the windlass. Under such circumstances they have to call in the aid of the winds of Heaven to aid them in separating the good from the worthless material by a process like that of winnowing. It is evident that none but very rich mines could be worked under such disadvantages. Probably in the mines I have been speaking of they will find it necessary a few years hence to convey the ore to some lower altitude, where there is water enough, or if not enough where it can be supplemented by steam.

The first process after the preliminary separation, of which I have just spoken, is that of "spalling." This is done by means of a flat-faced hammer, called a bucking iron, or a plate of iron called a bucking stone, and it requires a good deal of skill to administer just the proper force in the blow. If a man were cracking a nut with a hammer, his object would be to break the shell, and leave the kernel untouched, and in spalling some ores almost as great nicety is required. When the ore is very dradgy and mixed, it is called "brangled." The implement then used is that called a "picking hammer," and the ore is left of several sizes, but care is taken not to reduce any of it to powder. In the western districts the "cobbing hammer," which is capable of dealing with tolerably hard material, is used. In most cases in England the men employed use these hammers with singular dexterity, as the piece of ore is held by the fingers until the blow is given, and yet they escape the effects of it. In Anglesey they use a rough glove, with cast-iron rings round the fingers to save them from the blow. The best portions of the ore after spalling are hand-picked, and will be ready to go to the smelter—that is, to market; the second best to the grinders to be crushed; the third to the stamps; and the fourth goes to the deads, or dead heap. In large mines they have two kinds each for the grinders, and two for the stamps. Of the other classes of apparatus only two or three out of the hundreds of different kinds which have been invented will need particular notice. It has often been held to be convenient instead of letting lumps go to the crushers or to the stamps respectively too large, to submit them to some sort of hammering, and for this purpose a "tilt hammer" is used. It is worked by a wheel, which lifts a hammer of considerable weight, and the ore is thus broken up to a particular size; but there is this great objection, that its action breaks a good deal into a fine powder, which has to be heated differently to the coarser material. In some cases the simple pestle and mortar come into play. This is not seen in Western Europe, but in Eastern Europe, in dealing with gold which has to be amalgamated it is very useful. A modification, which is called Britten's machine, is employed with success in the Dolgelly mines and elsewhere. It is simply a basin of cast-iron, which has a socket at the bottom, on which a steel pestle is made to work with a wheel turned by water. This apparatus has been found to be very serviceable where ores have had to be worked on a small scale, but it is totally inefficient in dealing with large quantities of material, such as gold or tin, where thousands of tons have to be worked to a small size. Next comes that well-known machine the arrastre of Spain, largely employed in Mexico and South America. Anyone who has seen the apparatus by which flints are ground to powder in North Staffordshire will know what the arrastre is. A circular floor is laid of extremely hard blocks of mountain limestone, and the periphery surrounded by a boxing or kerbing of stone. The material to be crushed is enclosed in this, and a large heavy mass of chert is placed upon it and drawn round, by which means a great degree of trituration is effected. This machine has been greatly improved by Dr. Francfort at the gold mines of Northern Italy. Another valuable machine of this class is the edge mill, in which a couple of round stones, like wheels, are turned on their edges within the box of the arrastre. All these apparatus, serviceable as they may be when it is wanted to get the material into an extremely fine state of powder, are unsuitable for many of the ores, seeing that in the case of some where the material is reduced to so fine a state, and water is applied to it, there will be a most material loss. What is required is to reduce the ores to the size of gravel, or to such an extent as to enable them to pick out little specks and spots of metal mingled with the veinstone.

Another apparatus has been greatly used of late years, by which a large mass as it comes out of the mine may be broken up in a short time, and "spalling" superseded. It is called "Blake's Stone-Crusher," and as a preliminary to the other processes it is a very valuable adjunct, besides which it saves a vast amount of manual labour. In the large room upstairs there is a working model of it. Somewhere about the year 1810 an implement of this kind, called the Tavistock Crusher, came into play, particularly in the lead mines of the Dartmoor district; and it quickly obtained a footing in Cornwall, but for many years it was but little known on the Continent. It is a curious thing that while many of our very best processes have been imported from Germany, this, which was a great improvement on the continental crushers, should be so long in making its way there. This grinder is composed of a couple of rollers, with a cast-iron surface from 1 to 2 ft. in diameter, and 3 ft. in length. These rollers being set in revolution towards each other, the material is put between them, and its work is so well done and so cheaply that many of the poorer ores are worked, which otherwise could not profitably be touched either by manual labour or by the stamps. In the mines of the Hartz, where it is now used almost to the exclusion of all other crushers, an improvement has been introduced by placing a strong spring behind the back of the pressing pin, which gives a greater regularity to the movements of the rollers. The rollers are made of cast-iron, and being subject to great wear and tear a system has been adopted of employing a shell, which can be taken off when worn and replaced, the core within being a separate piece. In some English mines it has been found advisable to make the rolls less than 2 ft. in diameter, but they are seldom less than 18 in. Abroad, however, I have seen them only 12 in., but they then appeared to me to be very ineffective. I have also seen the length reduced to a foot or 14 in., but about 2 ft. is the usual size. When larger it is found that the rolls do not get through more work, and they give more trouble by wearing unequally, so as to have hollows and cavities on the surface. Cast-iron is a material of very uneven texture, so that it is often necessary to have what are called "chat rolls" to take up the pieces that escape through the cavities of the principal rolls. Now and then in certain mines where very good work is done rolls have been tried of increased length and diameter. Thus, there are rolls at the Devon Consols Mine 22 in. in length and 34 in. diameter, the lower one being 32 inches. They have strips along the sides of each roller which do not come together, and after a time they work into each other, and are said to wear a long time. In cases of extreme toughness and tenacity, about 5 tons are got through in the hour, but with softer sorts of veinstone from 12 to 15 tons. In Cornwall, with some stuffs 20 tons are crushed in the hour, but the average of the harder and closer material is from 20 to 80 tons in the day. The speed at which these rolls revolve is a somewhat important question. The circumference should move at the rate of from 30 to 80 ft. in a minute. That, at least, is the margin within which they work in Cornwall; but they work quicker on the Continent. If, however, they go quicker, a greater amount passes through unbroken or not sufficiently broken, and requires to be done over again. A stream of water is sometimes run through the rolls to keep them from heating, but as with many materials this would only transform it into a tenacious paste, it is more frequently necessary to grind dry. When the material comes out from the rolls it is run by a kind of spout to a sifter, through which the smaller falls into a trough, a stream of water in which carries it to the next process. When worked dry it is allowed to fall into barrels or wagons, which run on a tramway, by which it is conveyed to the place at which it is to be further dealt with.

Another and a not less important branch of comminution is that effected by the stamps, and to enter into all its details would require several lectures. The stamping process is principally applied to all tin ores; to nearly all the gold ores, or rather to all substances containing gold, and particularly to auriferous quartz. There used to be one mine in Cornwall in which tin ore was treated with crushers, but even that is now given up and the stamps brought into play. The enormous extension of gold mining which has taken place of late years has led to innumerable attempts to improve the comminuting process. Hundreds of patents have been taken out here and in America for this purpose, but nothing as yet has been found to supersede the stamps for dealing with the poorer and also the more disseminated ores, such as silver, copper, lead, and tin on a large scale. The stamps are a very simple apparatus. They are placed either in a single range, or in batteries consisting of three or four and sometimes five ranges. They are neither more nor less than a series of heavy pestles working a rectangular mortar or box (called a "kofer"). They are worked by means of a revolving cylinder, made of massive timber, and fitted with "cams," which in the revolution of the cylinder meet in turn with a corresponding tongue or projection on the pestle or shaft of the stamp, which is thus lifted and let fall with its full weight on those to be operated on, of which, after being previously reduced to fragments of proper dimensions by spalling, a supply is introduced into the kofer. The pestles are shod with a long piece of cast-iron, and the piece at the bottom is called a stamp-head. The lift in Cornwall is generally about 8 in. In a large mine the batteries will contain upwards of 100 stamp-heads, and when all are working together the din they create is completely deafening. The material is supplied from hoppers by means of a spout, arranged as to pass it to the back of the stamper, and then when the material is sufficiently comminuted it is passed away to a stream of water. Where there is good water power as many as 50 heads may be worked by that means, but if a larger number steam is necessary.

Let us make ourselves acquainted with the principles and practical working of this machine, so as to understand why its results are so successful. First, we will take the stamp itself and its lifter. The head is made of the hardest cast-iron, but of a quality not too brittle. There is a great wear and tear of the stamp-head, which is not only the cause of great expense, but detrimental to the ore. Thus, when the iron worn off the stamp-head gets amongst tin ore it is carried by the smelter, and has to be got rid of by some intermediate process. To remedy this, chilled iron and (in other cases) steel have been tried, but hitherto no steel heads have been found to answer, although it is probable that some variety of steel might be prepared to suit the purpose. At present, however, they are still made of cast-iron of the hardest variety. The stamp-heads are fitted to the lifter by means of a shank, which is cast in it; and the usual form is more or less quadrangular. The weight differs according to the work which has to be done. Thus, for instance, for tin or gold ore, or any tough stuff, it is necessary that the stamps should be very heavy, and in this country the heads are from 3 to 6 cwts., besides which there is the weight of the lifter, which by preference is made of wrought-iron in Cornwall, where there are to be seen several remarkably fine sets of stamps. The blow is given by means of a cam attached to a revolving cylinder, which lifts the stamp by a tongue or tappet, until passing on in its revolution the tongue is withdrawn, and the stamp falls free and with all its weight. That motion being rapid, there is a great friction and thereby loss of power, and many ingenious contrivances have been made to lessen that friction. One of the best of these is to make the cam of a curved form. In other plans the lift is from above, but most of these devices lessen the effect of the fall. It must be remembered that this is an apparatus which has to deal with material a large proportion of which is of an extremely obdurate character, and each of these heavy stamps may be drawn up and down 60 times in a minute, and, therefore, no delicacy of arrangement can be admitted. The lift is from 8 to 10 ft. in length, and arranged so as to bring the weight down as vertically as possible. This is a difficult matter sometimes, for the stamp-head after working some time will be worn down 2 or 3 in., and at last will get out of reach of the cams, and then a re-arrangement must be made. In California they have longer cams, which lift more evenly than ours. The kofer is a box generally made of wood, the dimensions of which are regulated by the number of stamps. If water be used a considerable stream is made to flow into it so as to carry off the material as soon as it is stamped fine enough, and a good deal depends upon the shape of the outlet. The stamps are made to work close to each other, not more space than 1 or 2 in. being left between them. The way in which the material is got rid of will depend in part upon the degree to which trituration is carried out. With gold in a high degree, and tin and copper in a smaller degree, a great deal of the material if reduced to too fine a powder will pass away in the water, and never be got back again; and cases have been known in which 50 per cent. has been lost in this way. The bottom of the kofer is formed of the hardest material that can be obtained. In the more modern systems now in use in California the stamps work on an iron plate, and on a sort of anvil, which is made for the purpose in the bottom of the kofer. Anything struck on this anvil is sure to be broken sufficiently by the first blow, and then by an ingenious contrivance it is released as soon as possible without it getting another blow. The wear and tear of the plate is not so great as that of the head itself.

To get rid of the material as early as possible a grating is most usually employed. In a copper mine it is simply a series of bars, with openings between sufficiently large for the crushed material to go through. The bars are shaped so as to be closer at the top than at the bottom, the result being that if the material once passes through it has no difficulty in getting away, and the bars are not likely to be clogged. It is very important to give a free exit to the material, and one of the greatest improvements in the stamps of modern times has been effected in this particular. A very bad system was in vogue in the older gold mines, by which a sort of pipe was placed at the top, through which the water constantly flowed over, and by which much of the finer gold-bearing material was lost. A well-known illustration of the skill with which the Nasmyth hammer can be managed is that it will crack the shell of a nut without injuring the kernel, and the action of the stamps upon veinstone should be the same. The object is simply to crack it so as to deal with it afterwards for the purpose of separation, and after the blow to pass it off by water. The heaviest stamps are those applied to tough and obdurate stuffs, and the effect will be in proportion to the fineness to which it is wanted to reduce them; and this will regulate the action, and make it slower or faster. It is desirable to know what amount can be got through with the stamps in a given period. It is in that respect an apparatus which will contrast favourably with other machinery with which the same sort of work is proposed to be done. Each head ought to make 60 blows a minute, and thus in 24 hours it would get through a ton of material. Without this it would be impossible to get a due return for a large mine. Take, for instance, a large tin mine in Cornwall, the veinstone or tinstuff of which is some times very hard, the quantity got through is frequently from 25 to 35 tons a day by one set of stamps. This is exceeded at Schemnitz and Chemnitz, where there are 2000 heads constantly going; and in the new gold districts of California and Australia many thousands of tons are got through in a year. Perhaps, however, nothing has been equal to that accomplished at the St. John del Rey Mine, in Brazil, where from 70,000 to 80,000 tons of material are crushed in a year. Within the last few years an important modification has been proposed and carried out at the Lake Superior copper mines, where they have one large head instead of a number, which is worked after the fashion of the Nasmyth hammer, and it is said to answer admirably. A firm of engineers in Cornwall, Messrs. Harvey and Co., took a hint from a hammer exhibited at Paris in 1857, and have perfected a very ingenious arrangement of stamps, by which the lift is made of a crank, and each lifter working within a cylinder as a piston, instead of coming down by the mere gravitation is drawn with great force by the resistance of the air. It is curious to see what six heads so worked will accomplish. They are worked at three times the velocity of ordinary heads, and give 160 blows in a minute. This plan, if it prove satisfactory at all points, would in many mines greatly reduce the number of heads, and thus produce a great saving, not only in labour but in wear and tear. It is on its trial, but until it is erected somewhere on a large scale, and accurate accounts kept of its performance and the expenses of its working, it is impossible to say whether it will supersede the older systems.

LECTURE LIX.—I have endeavoured to place before you the principal means used for pulverising ores, and the apparatus which follow next, for the purposes of concentration and separation are so extremely involved and numerous that it is well to preface what is to be said here on the subject by mentioning a few places where further information may be found. Amongst these I would mention, first, a most admirable 4to treatise on the mechanical preparation of ores at large by M. Rittinger, for which he received a medal of the higher order at the Great Exhibition of 1862. It is entitled "Lehrbuch der Aufbereitungskunde," and is illustrated by a large series of 34 plates. Several French books and isolated papers in the French scientific reports of the Annales des Mines give an account of the various machines and different sorts of applications used throughout England. There is a short sketch of the mode of dressing tin and copper ores in Cornwall by Sir Henry De la Beche, in the Report on the Geology of Cornwall and Devonshire; and you will find an account by myself on the processes employed in Cardiganshire, published in the Memoirs of the Geological Survey, Vol. II. There is also a small duodecimo, by Messrs. Phillips and Darlington, "Records of Mining," &c., which contains useful accounts of dressing apparatus; and the large work recently published by Mr. J. A. Phillips on "The Mining and Metallurgy of Gold and Silver," with reference more especially to the newer methods now in use in California. I ought also to mention the recent work of M. Gatzschmann, professor at the Mining Academy of Freiberg, "Die Aufbereitung," the conclusion of which has not yet appeared. A review of all the apparatus of this class would open out an interminable vista, the variety of which, however, is not great so far as principles are concerned, but in detail the differences which result from working the material in a dry or in a wet state, or up to various degrees of fineness lead to a great variety.

With regard to separation in a dry state, that by comparison is so exceptional that I need say nothing with respect to currents of wind generated by fans to winnow the material. The great work of separation is managed by currents of water. The impetus given to the moving material by this means varies according to the inclination down which the fluid passes, the amount of water, and the area over which it flows. It is obvious, the inclination being the same, the water will have a stronger effect in a narrow than in a broad stream. Then the gravitation of each particle, the friction against the bottom and sides to be overcome; and, lastly, the cohesion amongst the particles themselves must all be taken into account. The last is an important condition in all cases where the material is pounded into a slime of various degrees of tenacity. All these apparatus consist more or less of inclined planes, but there are a vast variety of them. If we look back for centuries we shall find in the old work of Agricola, to which I have so frequently alluded, a great many plans in use in his day, and which do not materially differ from the Cornish tin stream tye system—in fact, they are exactly the same in principle. [The lecturer here explained their construction by referring to models and diagrams.] The terms "buddle" (German, "heerd") and "frame" are applied to a great variety of apparatus. When the material first comes from the "stamps kofer," or as it is often called, the "stamps pit," it is passed over a griddle, by which a sort of division takes place. This is so rude and insufficient that it cannot be depended upon, and so large troughs of wood, called "tyes," are employed, which vary in length, but are usually from 9 to 15 ft. long from each, at which the material passes to the next, the stream of water leaving the heavier pieces or particles in the earliest, and leaving them quite in a state in which the water flows out at the last comparatively clear. Sometimes they have a box, called a "saver," before the tyes, which are usually three in number, and after them a "slime pit," in which the water ought to be left long enough to allow all the valuable material remaining to be deposited in a kind of slime at the bottom. In this partitions of board are put in so that the under is water to travel a considerable distance. In spite, however, of all these precautions there is a loss of a considerable percentage. It is also important to get a sorting according to size. If the material is composed of parts which have different specific gravities, and it is set moving by means of water, the separation of one from the other is easily made; but in order that this may be done the mass must not be of all sizes—that is to say, of small lumps, and large, and, therefore, something must be done to secure this important preliminary. This renders the work so involved and so expensive. To meet this difficulty the German miners make the first tye rather narrower than No. 2, and No. 3 still wider than No. 2, so that the current is made in each to spread over a wider area than in that preceding, and the heavier class of grains will have a tendency to deposit. This is not sufficient, however, to size the material, and it is, therefore, made to pass over a griddle, to which a shaking motion is given, like that by which a common sieve is used. Griddles are used now a great deal more than they were formerly.

Another plan, however, has come into play very largely, called "spitzkesten," proposed by M. Rittinger, by which the floor of each inclined plane is divided by a number of V-shaped hollows, which will retain some of the rougher stuff, while the remainder goes on to the next, and so on. This tends, however, to draw out the fine material as well as the rough, a disadvantage which is obviated by giving the tube a turn—syphon-like—with a stop-cock. This plan has not been long used, but last summer at Schemnitz and in the Hartz, where they have wonderfully fine dressing apparatus, it was in use, and was said to be a decided improvement upon the old system. By it there is a better assortment in the first instance; and, secondly, its action is continuous, as there is no stopping to dig out, and each hollow, or V, may be passed at once to the next. [The lecturer then explained by means of a model the buddles used in the copper, tin, and lead mines of this country.] The buddle is a rectangular box, formerly about 8 ft. long by 3 or 4 ft. in breadth, but of late years it has been made of much larger dimensions. There is a mixing box over and above it, with a head board next to the body of the buddle. The mixing box (called by the Germans "gumpe") is a very simple affair, into which the material is thrown by the shovel, or let in from the barrels, in which it is conveyed to the spot. The material is then passed along a grating to an inclined plane, from whence it may be at once admitted into one or other of the channels which come next. In this way the material is divided into heads, middles, and tails, the last being re-acted upon if necessary. This process, in fact, is often repeated several times with each division, until the heads will be clean enough to go to "pile" as marketable ore. With the slimes, a division is made in like manner, but an adjunct of this is a system much used in some districts for tin dressing, sometimes called "the dolly tub" process. The material is well mixed in the dolly, and is then allowed to subside, the heaviest of the substances going, of course, to the bottom, and so they have successive layers of different values.

Another aid is what is called "packing," in which a blow is given to expedite the settlement, but this can be given better by machinery than by manual force. One of the greatest revolutions in dressing, and one which has gained a general acceptance in a wonderfully short space of time, is the substitution of a round for the rectangular buddle. These are made from 16 to 24 ft. in diameter, and on a centre spindle arms are made to traverse the contents of the buddle by machinery, and no doubt effecting a most perfect action as regards mixing. A magnificent specimen of this sort of apparatus may be seen at Wheal Hows, in Cornwall, where the buddle is 50 ft. in diameter. In all buddles it is necessary, with a view to keeping the surface in good order for the people working them, to brush the surface with a light hand, using a broom or hoe for that purpose, it being important to keep the action as equable as possible. It is a matter of discussion to this day whether the start should be made from a large diameter or a small one. Some people hold that with a 6-ft. diameter a better separation is obtained than with a larger one; but these are matters of detail, in which one plan may be right under one set of circumstances, but prejudicial under others. Borlase's buddle, for instance, has many admirers amongst tin dressers, but instead of a convex circular floor it is concave. [Mr. SMYTH showed its construction by a diagram on the board, showing that by its action the centre became the place for the waste, an arrangement which seemed to him to be open to objection as requiring more careful attention and liability to the loss of valuable material.] He concluded by mentioning the fixed frames of Transylvania, 20 ft. in length; the sleeping frame of the French miners; and those of Cornwall, which were of almost all dimensions.

SOUTH MIDLAND INSTITUTE OF MINING, CIVIL, AND MECHANICAL ENGINEERS.

The monthly meeting of this Institute was held in their rooms on Monday. In the absence of Mr. J. P. Baker, Her Majesty's Government Inspector of Mines (the President), the chair, at his request, was taken by Mr. H. BECKETT (past President). There were also present Messrs. D. Jones, B. P. Walker, S. Bowkley, T. Rose, J. Laxton, T. Price, S. Fenn, W. Underwood, J. Hawkins, E. Hawkins, E. Meacham, S. Watkins, and John Randall. Mr. John Brown, of Cannock Chase Colliery, and Mr. John Southan of Oaken House, Oaken, were elected new members. The business of the meeting was the discussion of Mr. D. Jones's paper, upon "The Sulphur Springs of Chillington and Codsall Wood, localities between the South Staffordshire and Coalbrookdale Coal Felds."

The CHAIRMAN read a communication he had received from Mr. E. Hull, who was at the head of the Geological Survey of Ireland, who, writing from his department in Dublin, said—"What you relate about the sulphur at Chillington is of interest, and its occurrence is difficult to account for. There is not much—in fact, all the evidence is against the supposition of volcanic action in Triassic times in England. There was probably volcanic action at the close of the Carboniferous period, and during the early Permian period; but I know of no evidence of anything during the age of the Keuper which occur at Chillington. Possibly the sulphur exhalation may be connected with the drift in some way. I would rather not offer any opinion on this matter, because it is impossible to form a proper one of any value, without a full investigation of the subject." The Chairman then gave his own views of the question. They were of considerable interest, but the rules of the Institute forbid more than a very brief statement of them in other than the authorised "Transactions" of the Institute. The same remark applies to the lengthened and valuable remarks by Mr. Randall. The Chairman stated that he visited the springs, some time ago, with the late Mr. Jukes, for thermometrical purposes. As sulphuretted hydrogen had been found in connection with our New Red Sandstones of the Keuper order, it did not follow as a matter of course or absolute necessity that direct volcanic action may have taken place between the South Staffordshire and Shropshire coal fields, although it was true faults were occasionally traceable in the rubicund strata, which might possibly have been the lateral result of unquestionable volcanic upheavings in our two coal fields.

Mr. BOWKLEY pointed out that sulphur springs were sometimes found where petroleum and naphtha were found. In the instances in question, there was no doubt that the coal measures underlay the New Red Sandstone, and hence the existence of the springs.—Mr. Laxton gave local facts which he thought might bear upon the investigation.—Mr. B. P. Walker, with the hon. sec. (Mr. T. Rose), and others, engaged in the discussion.

Mr. RANDALL delivered an address which was little short of an exhaustive essay on the whole question of the probability or otherwise of the existence of coal between the Staffordshire and Shropshire known fields. He did not regard the springs as indicating the existence of coal measures. Sulphuret of iron they knew to an extent sufficient to supply sulphates to act upon the bases of lime and magnesia. Such were found in the magnesian limestone of the New Red Sandstone; and the filtration of water through the laminated rocks might supply, or assist in supplying, the chemical action required for the production of such springs.

Mr. JONES, in replying upon the whole discussion, held to the opinion he had expressed that the springs to which he had drawn attention indicated the same state of things as existed at Newent, in Gloucestershire, where, as Sir Roderick Murchison had pointed out, there was a sulphur spring in connection with coal of the new formation, like that which was found in the Forest of Wyre. Mr. Jones then went into the question of the existence of coal in the locality between Staffordshire and Shropshire, agreeing with Mr. Randall's views upon the denudation theory, but dissenting from him as to its extent in a westerly direction, where, at the extreme point, he believed the evidences were those of dislocation. Mr. Jones illustrated his arguments upon the springs by a reference to the geological map of the locality, and to a diagram, copied from that of Sir Roderick Murchison, upon the Newent sulphur spring.—The Chairman, the hon. secretary and Mr. Bowkley, all expressed a high sense of the great scientific worth of the debate.

THE LATE SOCIAL SCIENCE CONGRESS, AND THE PEACE QUESTION.—It is cheering to observe that the advocacy of Peace—European Disarmament and a general system of International Arbitration—claimed prominent attention at the late Social Science Congress at Newcastle. Amongst the influential gentlemen who took part in the meetings and discussions on that occasion, and supported decided peace views, were many of the leading members of the Social Science Association, including Mr. G. W. Hastings, its founder and honorary secretary. In the jurisprudence department, valuable papers in favour of pacific principles of international law and modes of arbitration were read by Professor Leone Levi and Mr. Thomas Beggs. Respecting the paper by the latter gentleman, the *Newcastle Chronicle* observes:—"The arguments by which Mr. Beggs sought to sustain both propositions were of the most cogent character, and we observe from the subsequent discussion were cordially endorsed by the Duke of Northumberland, Mr. J. M. Ludlow, and Mr. Henry Richard, M.P. The war has given a vast impulse to peace principles." On that occasion Mr. Richard, M.P., mentioned a number of interesting examples of the successful application of arbitration in preventing war and settling national differences. The discussion resulted in the passing of a resolution requesting the Council of the Social Science Association "to appoint a committe to consider whether some general scheme of international arbitration or conciliation cannot be recommended for adoption." During the stay of the congress in Newcastle a crowded and enthusiastic peace meeting was held in the Town Hall. Mr. J. Cowan, jun. (proprietor of the *Newcastle Chronicle*, and son of Mr. Cowan, M.P.), occupied the chair. Eloquent speeches were delivered by Mr. Henry Richard, M.P., Mr. Cowan, Mr. John Hodgkin (of Lewes), Rev. Dr. Rutherford, Mr. Arthur Trevelyan, J.P., Rev. J. C. Street, and other gentlemen. Resolutions were unanimously passed in favour of the abolition of standing armies and the establishment of a system of international arbitration.

IMPROVEMENTS IN TREATING IRON ORES.

FIG. 1.

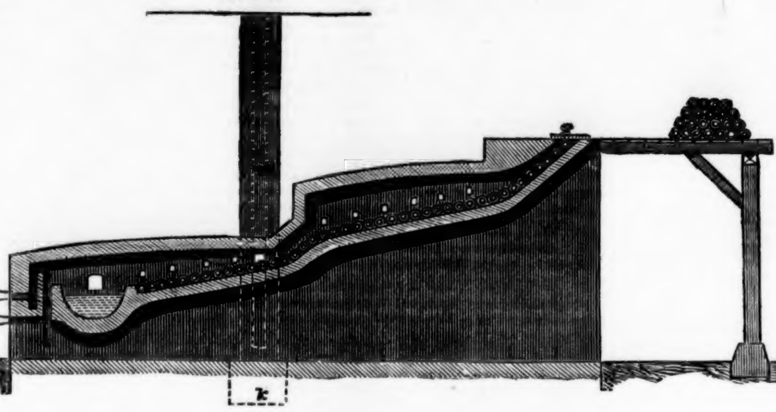


FIG. 2.

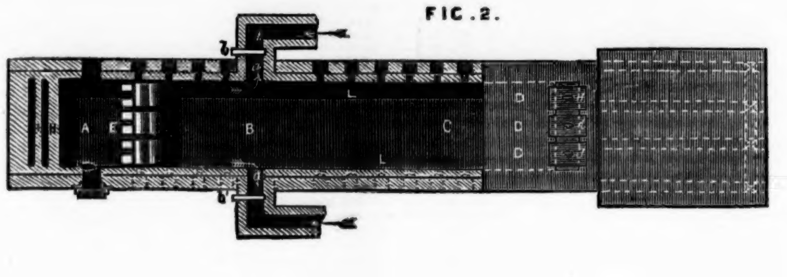


FIG. 3.

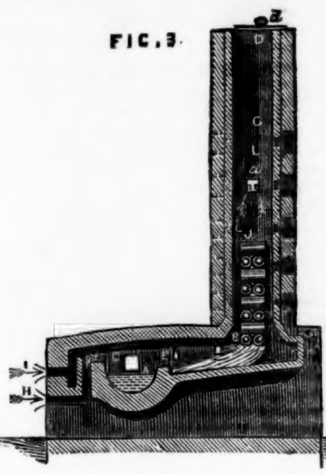


FIG. 4.

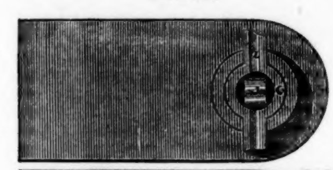
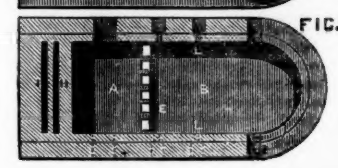


FIG. 5.



The invention represented above is a system of furnace so arranged as to permit the realisation for iron ores with the employment of flame of conditions of treatment similar to those produced in blast or high furnaces. In the upper part of the vertical trough of ordinary blast-furnaces the minerals are first submitted to a sufficient temperature to reduce and carburate them, but not high enough to scorify them. Then by the descent of the charge progressively approaching the tuyeres—that is to say, the part where the maximum of heat is developed—it arrives at the temperature of fusion when it is reduced and carburetted. This gradual increase of temperature and succession of operations are indispensable for the success of the treatment in high furnaces wherein solid combustibles placed in contact with the mineral are employed. It is evident that they are equally indispensable with the employment of combustible gases and flame.

The inventor, M. Le Brun-Virloy, of Paris, takes an inclined furnace by way of example, which will be seen on reference to Figs. 1 and 2 of the engravings. The furnace is formed of three parts—first, the melting hearth, A, into which the combustible gases and air that have been previously heated arrive separately; second, the melting furnace, B; and thirdly, the reducing and carburetting furnace, C. The temperature of the reducing and carburetting furnace ought to be much less elevated than that of the melting furnace. Therefore, at the end of the latter and on either side an escape orifice, *a a* 1, is made for the flames, which are led away by two escape chimneys (*cheminees d'appel*), after having been utilised either for heating the air and gases, or for the production of steam, or for other purposes. Only that amount of flame necessary to maintain the desired temperature is permitted to enter the reducing furnace. The progress of the furnace is regulated by dampers, *b b* 1, which are near the escapements, and obturating plates, *d d* 1, *d* 2, which more or less cover the charging orifice, D, at the end of the reducing furnace, whereby the flames finally escape after having passed through the said furnace.

The iron ores or ferruginous scoriæ should before entering the above-described furnace receive a preparation which consists in reducing them into very small fragments, or even into powder, in mixing them with the quantity of carbon necessary in order to produce their reduction and carburation, and with a convenient quantity of lime or clay either to serve as a flux for the gangue *(fondant a la gangue)*, or to closely unite the different matters, and lastly in forming them by ordinary means into bricks or blocks of any convenient shape. With inclined furnaces, such as that shown at Fig. 1, the object of which is to facilitate the progressive movement of the ore from the charging orifice, D, to the melting hearth, A, it is preferred to employ cylindrical blocks, J, and these may sometimes be made hollow, as shown in the drawings, which will be found to favour the operation. The progress of the operation will be immediately understood by reference to Figs. 1 and 2. The furnace is always kept full of blocks of the ores. In proportion as those nearest to the fire-bridge, E, become melted the others behind them are pushed forward, and the place of the latter is filled through the charging orifice. Side openings, L, are arranged in the walls of the furnace at the right and left, some at the level of the sole plate, and others above the blocks of ore, so as to permit of their advance being regulated. These openings when not required are closed by plugs or shutters of refractory earth, or by other means. The melting ore falls into the melting hearth, A, through holes made in the fire-bridge, E. The slag passes away through one of the doors, G, of the melting hearth, and when the latter is full the melted metal flows through a tap-hole, F, arranged at the bottom.

It is preferred that the carburetting gases should enter the furnaces through the lower, H, of the two orifices leading into the melting furnace with a certain pressure, in order to avoid the entrance of the air through the different openings. The air arrives above through the upper one, I, of the orifices, and is directed against the roof of the furnaces, the gases arriving about 4 in. (10 centimetres) below, in order that the ores may be as much as possible in a non-oxidising medium. The form, arrangement, and action of the horizontal furnaces are the same as those of the inclined furnaces. The vertical furnaces, one of which is represented in three views in Figs. 3, 4, and 5, differ, inasmuch as that the melting furnace, B, and the reducing and carburetting furnace, C, which is always at the back, are of similar section, so as practically to be the same, and rise vertically to about 30 in. (80 centimetres) above the fire-bridge, at a height of about 8 feet (2m. 50c.)—that is to say, above the vertical lower part, which serves for the melting furnace, are placed two escapements, *a a* 1, for the carburetting gases, the same as in the inclined and horizontal furnaces. The withdrawal by these escapes ought to be sufficiently active to leave in the upper part of the vertical portion of the furnace only the quantity of flame necessary to maintain the temperature for reduction and carburation. The charging orifice, D, is also stopped by one or several obturators, *d*, which permit more or less flame to pass through. The blocks of ore, J, which are preferably of a hollow cylindrical form, as seen in Fig. 3, are so charged as to leave between themselves and the walls of the furnace a sufficient passage for the carburetting gases. These blocks are preferred to be about 15 in. (40 centimetres) in length, and 7½ in. (20 centimetres) in diameter, and are arranged horizontally in crossed ranks one upon another in the furnace, forming a square column, leaving plenty of space between its four faces and the circular walls of the furnace. Side openings and doors are arranged in these walls as in the inclined and horizontal furnaces, in order that the descent of the blocks may be directed as regularly as possible in proportion as they become fused.

UTILISING COAL WASTE IN AMERICA.—Perhaps one of the most important, inasmuch as it has been demonstrated to be practical, inventions of the day, in view of the high prices of fuel is that referred to under the above heading. Some time since a company was formed in New York with a view to utilising the refuse of coal mines, the accretions of which have not only been enormous, but of serious inconvenience to the operator, and hitherto valueless. The enterprise has proved a complete success, buildings and machinery have been erected at Mauch Chunk, and the fuel as prepared from the coal dust is said to be superior to the natural coal, burning without cinder or impurity of any kind. Unfortunately for the good of the general public, the Secretary of the Navy after testing the fuel has entered into a contract for all the present works are capable of turning out. The fuel, as supplied the Government, is in cubes of 5 in. From the regularity of shape, great advantage can be had in stowage, while the absence of cinder and, comparatively, of ashes render it peculiarly desirable. The price is said to be lower considerably than that of coal in its present form. The supply of the refuse is inexhaustible, and this improvement gives us another advantage over the impracticable miners, who may strike at will if we can but utilise the dust which we have above ground by millions of tons. As a process has been lately ventilated by which coal has been ground to a fine dust, and carried by blowers into the furnace with sufficient air to produce immediate combustion, and with the most eminent success, we suggest the use of the dust already on hand for similar treatment, not doubting equal results will be obtained. Any process or invention which cheapens the necessaries of life to the consumer is of prime value, and as fuel may be looked upon as the *sine qua non* of industry, as of comfort, the inventions alluded to deserve more than casual notice.—*Iron Age.*

BOILERS.—The invention of Mr. T. W. RAMMELL, Westminster, consists in so making the plates and tubes for such boilers and vessels that any given area (say, a square foot of a plate or a tube) shall present more than a square foot of absorbing or of emitting surface, or of both, as the case may be, and thus give freer play to the conducting capacity of the metal. The inventor effects this object by raising certain parts of the substance of the plate or the tube above other parts, thus obtaining in the sides of raised parts an additional surface for fluid contact.

SPLITTING ROCKS.—By the invention of Mr. J. ROBB, New York, U.S., any desired number of holes are bored in the rock which is to be split, the same being similar to those made when gunpowder is to be employed as the disruptive agent. The hole or holes is or are nearly filled with water, on which pressure is exerted by means of pistons or plungers, capable of working in the holes in a water-tight manner, and which pistons or plungers are arranged in suitable framing, and actuated by any suitable motive power, as will be well understood. The pistons or plungers are formed of steel of sufficient strength, the lower parts thereof being constructed of a smaller diameter than the shaft, and on which smaller portion is fixed a piece of cork or other packing material, at the top and bottom of which are placed washers, the whole being secured on to the end of the piston or plunger, by means of a nut or nuts.

PREVENTING BOILER EXPLOSIONS.

The value of the fusible plug for preventing the explosion of boilers has been fully recognised by the steam-boiler insurance companies of Manchester, and in some instances diminished premiums have been accepted in consideration of the fusible plug being used; yet, owing to the inconvenience resulting from complete emptying of the boiler every time the water is permitted to fall too low, and from the doubt that was entertained whether the incrustation of the boiler would interfere with the efficient action of the plug, it has never come into very general use. The whole of the advantages of the plug, combined with perfect freedom from the objections mentioned, have been secured by the invention at present being introduced by the ASHCROFT PATENT DETECTOR AND ALARM COMPANY, whose arrangement is shown in the subjoined diagram. The instrument is made of a tube of iron or brass, as the case may be, terminated by a ball, on which is placed a whistle, having a fusible disc at the point of junction with the ball. The tube is connected with the boiler at or a little above the low-water line by means of a stop-valve, which in the ordinary state of things is locked open. The disc is fusible at 212°, and is capable of bearing a pressure of 250 lbs., so that whilst the boiler is in proper working order the apparatus will not be at all affected.

The greatest advantage, perhaps, of the apparatus is that it is not in any way dependent upon the action of floats, valves, levers, or any other mechanism, but solely upon the natural laws of gravitation and heat. Its action is remarkably simple. After the boiler has been filled to the water-line and put in operation, the pressure of the steam forces the water into the pipe, compressing the air therein into the air-chamber; the compressed air is, after the lapse of a few hours, absorbed by the water in the pipe and boiler. As there can be no circulation of water in the pipe as long as the lower end is under the water-line the disc will continue firm and solid, the water in the pipe being of a comparatively low temperature, never rising higher than 140° But when the water in the boiler falls below the end of the pipe the water in the pipe, of course, escapes into the boiler, and steam at once takes its place, softens or melts the plug, which is blown by the pressure of the steam from its seat through the stem into the air, and notice of low water is given by the sounding of the whistle.

As the whistle, once started, cannot be stopped until the valve has been unlocked and closed (and it is, of course, assumed that the key will be kept by some one in authority), neglect of the attendant in charge of the boiler cannot escape detection, so that the damage of the boiler by the burning of the plates without the knowledge of the principal, or his immediate representative, will be impossible. The apparatus appears to have given the utmost satisfaction wherever it has been tried; and, although less than three months have elapsed since it was first offered to the public, a large number are in use. In addition to this, it has just been officially announced that the "James Watt Medal" has been awarded to it by the Royal Cornwall Polytechnic Society.

IMPROVEMENTS IN STEEL MANUFACTURE.—Improved means and processes for the manufacture of steel in the ordinary puddling-furnaces are progressing at a rapid rate. One of these—the production of steel by the mixture of a peculiar ore found in York county with ordinary qualities of pig-iron—was described in this journal some weeks ago. The success then obtained has been followed with still further progress. Now we have a statement of the results of some experiments under another process, by which an excellent quality of steel has been produced, and in this case also in a common puddling furnace, which by a simple device was made equivalent to a crucible. The latter is the process patented by L. L. Vigor and General W. W. Averill. On Thursday last a demonstration of the process was undertaken at New Ringgold, in Schuylkill county, in this State, in the presence of a number of skilled and experienced persons, among whom were Mr. A. Pardee, of Hazleton, Mr. John Fritz, of the Bethlehem Rolling Mill Company, Dr. Roupper of the same place, and Mr. Metcalf, of the Crescent Steel Works, Pittsburg. During this experiment 350 pounds of "Canada Sand" ore was used, and the product was 248½ pounds of steel, or about 70 per cent. The time consumed, from the placing of the charge in the furnace until the molten steel was ready for the ingot mould, was 5¼ hours. As to the process itself, we can only give a general idea. The steel is made by the direct process and by a single operation. The material used is oxide of iron in a pulverised form (whether with sand ore or otherwise), first prepared by an admixture in the form of blocks, with carbon in certain proportions, usually of graphite or pulverised charcoal, or the best of anthracite coal pulverised and desulphurised. A sufficient amount of and appropriate quality of cinder or other material is used with which to furnish a fluid lid or covering for the oxide of iron when brought into the state of fusion. The best material for this purpose yet tried is glass, heated till it becomes liquid. This material floats over the molten metal, and being supplied so as to make a lid or covering about 4 in. in thickness, it protects the metal in its fluid state from decarbonisation. Thus the manufacturer is enabled to regulate the amount of carbon he desires to use with reference to the deoxydisation of the ore and to the surplus of carbon to be imparted to the metal. From the foregoing description it will be observed that the puddling-furnace is in fact converted into a large crucible, and that in a general sense there is no principle involved beyond the adaptation by previous preparation of the mixture with its proportions other than that which exists in the manufacture of crucible steel. While this steel is claimed to be of a fineness suitable either for razors or railroad bars, the manufacturers at Ringgold assert that the cost of production will not exceed 2 cents per pound. It was at one time deemed very problematical whether sufficient heat could be produced in the ordinary puddling-furnace, and the earlier efforts developed some difficulty in this respect. This now is said to be quite overcome, while it is conceded that with the Siemens furnace the supply of heat could be best regulated.—*Philadelphia Ledger.*

REGISTERING APPARATUS FOR MINES.—The apparatus proposed by Mr. E. L. RUELENS, Brussels, is composed of a series of wheels each having ten teeth, the first wheel marking units, the second tens, the third hundreds, the fourth the units of thousands, the fifth tens of thousands, and so on. Each of these wheels or discs have on their outer surface the numerals 0 to 9, so applied that at each appointed rotation of the disc one of them faces a small opening in a sheet-iron casing, which forms the cover or vertical face of the box in which the registering apparatus is set up. This arrangement of numbered discs permits the reading of the register at any moment as easily as if the return were inscribed on paper. Each disc is provided, first, with the ten teeth by which it is actuated under the action of a ratchet or lever fixed to the disc of lower denomination; second, with a small toothed wheel and spring escapement applied at the back of the disc to prevent recoil; third, with a small stop spring fixing the disc, and permitting it to advance only one division at a time.

RAISING LIQUID.—The apparatus proposed by Messrs. M'G. MASON and T. LOCKERBIE, Glasgow, for utilising the surplus water pressure consists of a vessel, which may be of any suitable shape or material, and which is divided into three compartments. One compartment is the reservoir for compressed air, while the other two are filled with inlet and outlet pipes for water at the bottom, and with valves at the top for air. The water is admitted from the service pipe through a reducing valve, and thence through a four-way cock to one of the two water compartments, which it fills, forcing the air from it into the air reservoir. When one water compartment, for example, is filled, the cock is turned to let the water off from it by the crane or swan neck, and to put the other compartment in communication with the service pipe.

BLACK PIGMENT.—The invention of Mr. F. ROTTER, Hamburg, consists in heating the hop bine in close vessels, and by pulverising the charcoal obtained by this treatment. As the hop bine has hitherto been wasted it may be had at a slight cost, and, therefore, the black produced therefrom will be very cheap.

TWISTED METAL BARS.—The machinery proposed by Messrs. M. MACDERMOTT and A. D. WILLIAMS, Kensington, consists, firstly, of cast-iron framework in three parts, of which the two at one end, connected together, support a drum of varying diameter for driving the machine, which drum is placed in the interval between these frames. Fixed on the same axle as the drum, and at one end of it, is an endless screw. At the other end is a cog-wheel, which works in another cog-wheel of greater diameter, the latter being fixed on a hollow shaft, working in bearings upon the standards. One end of the hollow shaft just mentioned is formed into, or has attached to it, a circular disc, the vertical axis of which coincides with that of the endless screw.

DRESSING STONE.—Messrs. W. BRASS and P. HACKWORTH, Islington, employ a horizontal bed or table upon which the stone to be worked is supported and firmly secured between the suitable adjustable fences and dogs, or screws. A rotating disc mounted on the end of a horizontal axis, and working with its face in a vertical plane, acts upon the stone which projects over the edge of the bed or table for that purpose, a suitable quantity of sand and water being applied in any convenient manner between the surface of the disc and that of the stone to be worked. The axis carrying the rotating disc has rotary motion given thereto, by preference from a pulley mounted on a counter shaft, receiving motion by a strap or band from a steam-engine or other suitable power.

PRODUCING GAS FROM MINERAL.—The object of the invention of Messrs. S. CLAYTON and S. TAYLOR, Manchester, is to enable the gas generator to be heated by means of the gas generated, and thereby to obtain a more portable apparatus and to lessen the amount of attention required, and also to obtain a more perfect decomposition of the oil than in the case of the apparatus before constructed. In order to obtain the requisite amount of heat, the inventors cause the gas which is to be used to heat the gas generator to mix with a

current or blast of air, so that the mixture of gas and air may issue from the pipe or burner under pressure, and may be directed in a burning state against the surface to be heated. The surface is, by preference, formed as a hollow truncated cone, projecting into the interior of the gas generator; and the surface is surrounded with a conical envelope, so that an annular space is left between the cone and the said envelope.

FOREIGN MINING AND METALLURGY.

The state of the Belgian coal trade has not experienced any improvement during the last few days. It remains as depressed as hitherto, and without any immediate prospect of improvement. The effects of the crisis in affairs are deplorable; coalowners and coal miners are alike suffering. At present the production has not been materially reduced, and wages have also not experienced any important change; nevertheless, credit has sustained a great shock, and scarcely any large contracts have been concluded of late. The disadvantageous position of their employers seems to be appreciated as it ought to be by the working population, who have preserved an orderly attitude. The coalowners, on their part, are doing all they can to ameliorate the lot of their workmen. The General Company for Promoting the National Industry of Belgium, which has large investments in colliery property, is setting an excellent example in this respect, having issued a second circular to the colliery companies in which it has an interest. This second circular observes:—"The sale of coal has experienced a considerable diminution, and this state of affairs has necessarily brought about a sensible slackening in the working of most of the collieries. The councils of administration of the various companies patronised by us will agree with us on the importance of mitigating as much as possible the unfortunate consequences which this state of affairs must have for their workpeople. The execution by anticipation and so far as practicable of works preparatory to future coal getting seems the best means of increasing, for the moment, the amount of employment available for workpeople threatened by a forced reduction in the extraction. We think it right to specially call the attention of your council to this matter." The agents of the National Bank in the Hainaut have also been convoked at Brussels, in order to discuss with the governor of the bank the best means of assisting the commerce and industry of the province of the Hainaut. The National Bank appears disposed to advance to industrials—at any rate, to some extent—such sums as they may require in order to enable them to employ their workmen. Contracts are to be let on the 19th inst. for the coal required for the Belgian State Railways during the first few months of 1871. The arrangements are somewhat modified as compared with those which distinguished the last similar contracts let in July.

Notwithstanding the war, a few scraps of metallurgical newshave reached us this week from France. We can make no report as regards the Haute-Marne, but as regards the Ardennes group it may be observed that traffic has now been suspended for several weeks past on the local railways. It is this interruption in the ordinary train service which has principally caused a stoppage of the metallurgical establishments of the Ardennes, as not only has it been impracticable to lay in stores of combustibles and minerals, but it has also not been possible to export manufactured products. It would be difficult to predict how long the present sad state of things will last, but it may be remarked that the Ardennes section of the Eastern of France Railway has been cut at several points, while numerous works of art have been destroyed. Notwithstanding all these disadvantageous circumstances, however, some works have been again brought into activity. Among the establishments which are thus in operation to a small extent may be mentioned the Blagny Works and the Wée forge, near Carignan; these concerns are only working to meet local requirements, and it is to be apprehended consequently that they will not be able to keep going very long, unless a restoration is effected of communications at present destroyed. The Châtillon and Commentry Forges Company has been paying during the last few days the balance of its dividend for 1869, or 14*s.* per share. The Bouches-du-Rhone Colliery Company has been authorised to increase its capital from 20,000*l.* to 20,000*l.*, in order to provide for the acquisition of the undertaking of the Boulladisse Mines Company. The additional 200,000*l.* is to be raised by the creation of 1000 new shares.

The Vollmond, a German Mining Company, reports that a hope entertained that the working of 1869 would be attended with favourable results has not been realised. The production, which had been carried little by little to nearly 7000 bushels per day, has since diminished, and it is now only about 5000 bushels per day. This unfavourable result is attributed to physical obstacles and numerous accidents. The total production of coal by the company in 1869 was 1,485,500 bushels, against 1,280,000 bushels in 1868. The sales last year comprised 1,386,386 bushels, against 1,177,674 bushels in 1868. The consumption of the establishment absorbed 100,940 bushels in 1869, against 100,565 bushels in 1868. Statistics recently collected show that the Hagen district, in Westphalia, effected a very large production last year; unfortunately, the present war threatens to check all further progress. The industry of the district in question occupies itself principally with puddled steel in various forms, iron in bars and rails. Tyres of puddled steel are stated to be in increasing demand in the Hagen district, in preference to those of Bessemer steel, which are said to break more frequently. Until the recent reduction in the price of Bessemer steel rails there was also an increasing exportation of puddled steel rails from the Hagen district, which expects to profit from the recent revision of American customs duties.

There is scarcely anything fresh to report in regard to Belgian metallurgy. The number of orders continues to diminish, but industrials are looking forward to the time when the war shall cease, and when it will become necessary to put into a good state—and that rapidly—lines of railway which have been destroyed or damaged during the struggle. Great quantities of material must inevitably be wanted, and Belgium hopes to secure a large, if not the largest, share of the orders which will have to be given out, as some French firms have suffered materially by the war, and will not be able to execute contracts with the necessary expedition.

Scarcely any transactions in copper are reported upon the French markets. At Havre, however, a speculative transaction has taken place in 10 tons of disposable at 64*l.* per ton, Paris conditions. The state of the German copper markets is considered to have been slightly improved by the raising of the blockade; transactions can scarcely be said, however, to be numerous at present. At Rotterdam previous rates have been about maintained. The Dutch tin markets present little animation; some transactions have taken place in Banca at Rotterdam at 74½ fls.; Billiton has changed hands at 73 fls. to 73¼ fls. At Berlin the lead market has been quiet. At Rotterdam, Stolberg, Eschweiler, and German lead of various marks have been dealt in uniformly at 11 fls. Zinc has remained comparatively neglected at Breslau, notwithstanding the raising of the blockade.

AUSTRALIAN MINES.

YUDANAMUTANA (Copper).—The superintendent (Adelaide, Aug. 15) states: By this mail we are sending a telegram to you to be forwarded from Galle. This you will have received long here this. I have now only to mention the progress of the discovery. When on my late visit I went underground, the lode was 2 feet wide; when I wrote to Mr. Laurance (July 12) it was 3 feet, and widening. This was considered a wonderful lode. In a week after it was 4 ft. wide. On July 29 it measured 16 feet by 6 feet, with no appearance of wall or water. A week after it had been proved to be 16 feet east and west, the length north and south not ascertained; water on the bottom 9 in., quite hot. Capt. Terrell, under date of Aug. 1, reports:—As regards the lode I never saw such a thing in my life. How long it is I don't know; it is from east to west 16 feet, but how wide it is from north to south I do not know. It is a wonderful lode, and much softer. The water rose about 9 in., and quite hot, and the ore is richer in quality, more black oxide with it. The captain states that since my last the men have sunk 3 fathoms in No. 1 winze, the lode improved in size all the way down; it is now 16 feet from east to west, but how wide from north to south I cannot tell. We have been carrying the winze 6 feet by 6 feet, with no signs of any wall. The lode is as solid as it can possibly be of ore, about 30 per cent.; it is really the finest lode I have ever seen, and in my opinion will be still better on account of the large quantities of leaders coming in from the south, and the droppers coming from the hanging wall north of the lode. I am very pleased to say that we have now cut water; this is what we have long been wishing for, as a supply of water will allow us to make use of all the low class ore which we have hitherto thrown aside, and there are many thousands of tons of from 3 to 8 per cent. I do not hesitate to say that the mine will now prove itself to be the best mine in the colony.—No. 2 Winze: The lode in this place is still very small, about 9 in., but the ore is of a very good quality. The men are still stoping.—No. 3 Winze: The lode in this winze is looking poorer than when I last reported. The stope in winze south of No. 1 is looking very well, about 10 feet wide, of good smelting work, and I believe it will be richer as it goes south. The lode in the bottom of the 10, between No. 3 shaft and No. 2 winze, is looking much the same as stated in my last report. Since my last I put two men to sink on a small leader a few fathoms north of No. 3 shaft 10 fm. level. We sunk 2 feet, and am pleased to say cut a fine little lode of ore, about 1 foot wide, running north and south. This is all in whole ground, as nothing has been done between No. 3 and No. 2 shaft. There is not the slightest doubt that we shall find many good lodes of ore now we have cut this leader. I have now put four men here. These are all the places in the mine now at work. The mine has never looked so well as at present; but on account of the great depth of No. 1 winze, where there is the greatest quantity of ore, it has to be hauled twice by windlass to get it to the 35, and then wheeled to the shaft to be hauled by the engine to surface. In consequence of this laborious manner of raising the ore, it prevents us making that progress we should do if it were hauled by a direct shaft, and we should be able to raise four times the quantity of ore in the same time. In sinking a direct shaft, we should cut through several lodes of ore that would, in my opinion, pay for the sinking of the shaft. Ore raised from Aug. 1 to the 8th, 54 tons 10 cwts.; smelted, 58 tons; on hand, 24 tons 10 cwts.; copper made, 9 tons 10 cwts.; dispatched, 8 tons 13 cwts. 2 qrs.; on hand, 3 tons 1 cwt. 1 qr. There is an abundance of wood coming in. After the 20th inst., we intend reducing the price, as there is an abundance of feed and numbers of carters. Everything now is going on satisfactorily, the weather is still very unsettled, but everything points to a good season for the North.

PORT PHILLIP AND COLONIAL (Gold).—The directors have received the following telegram, dated Galle, Oct. 2, in advices of the mail leaving Melbourne on Sept. 11, and due Sept. 31:—"Yield keeps up; all going on well."

ENGLISH AND AUSTRALIAN (Copper).—Port Adelaide, Aug. 15: The quantity of coal at Port Adelaide was about 519 tons. At Port Adelaide the fires were re-lighted after the annual stock-taking, and there were two melting furnaces and two roasting at work. The refinery would be re-lighted in a few days. With reference to the Newcastle works the manager writes:—These works are now ready for fire, with two smelting furnaces, one roasting and one refinery furnace. The two remaining furnaces are being progressed with, all materials being on the spot and paid for; labour is the only charge. And as regards the new wharf he writes:—We are now laying down a line of rails, the Government finding all materials and we all labour, for which, however, we are to be reimbursed. The Goolwa and the Claymore are now alongside. The 185 tons copper advised by last mail as in course of shipment had been shipped.

AUSTRALIAN UNITED (Gold).—The directors have advices, dated Fryerstown, Aug. 13: Mr. Kitto writes:—Duke of Cornwall Mine: You will observe that we have commenced cross-cutting. The longitudital section (sent herewith) shows the dip of the quartz rock towards the north, as also the northerly dip of the flookan, which has apparently had such a large influence on its gold-bearing qualities. In the cross-cut section the westerly underlie of the flookan is shown. The Messrs. Rowe Brothers' mine is increasing in richness very rapidly (they have crushed during the last month an average of over 1¼ oz. per ton, from a lode larger than any other in the colony). I begged permission to be allowed to make an inspection of their mine, which they readily granted. Accompanied by a gentleman from Ballarat, who had come from that gold field to examine this now famous line of reefs, I made a thorough inspection. There is not a portion of the mine where gold is not visible to the eye, and in their bottom level the quartz is divided into three veins—80, 35, and 5 feet thick respectively: a total of 120 ft. Rowe Brothers are under the flookan much further than we have been, although not so deep from the surface. Capt. James Rowe informed me, when underground, that he had been working his mine for a period of nine years, during the whole of which time he had been only two months without giving dividends. Hilton, Mills, and Co., who adjoin Rowe Brothers on the south, divided 2400*l.* between the six partners during the month, as the result of one week's work. I think you must in all fairness acknowledge that I have had good reason for clinging so closely to this property.—Central Mine: That on which we bottomed now proves to be a tributary or little gutter, running towards the main one. There is a wide field of wash all around, but this, although payable, is not what we have every reason to expect. The pieces of gold we have found in the small gutter are mixed with quartz, thereby indicating a lode close by. The agents' monthly reports to Mr. Kitto are as follows:—Duke of Cornwall Mine—Capt. W. H. Williams, Aug. 13: I beg herewith to hand you a report of the progress of the mine since the 10th ult. Dauke's shaft (engine) has been sunk about 14 feet 6 in., and timbered about 15 feet, as the shaft required close timbering where the flookan intersected it. A new level is now commenced at a depth of 62 feet below the 200 feet. We hope to cut the lode in about two months from this. No other change of importance.—Central Mine—T. Angove, Aug. 13: I have the honour to report that the western drive has been extended 210 feet from the shaft, the face of the drive still in slate. At a distance of 100 ft. from the shaft the wash thinned out against the reef, showing the main run to be in a direction west and south. The drive has been continued into a westerly course in slate for 110 feet, and to-day a bore put up to ascertain the inclination of the reef, at the time of my writing had not passed through. The ground is favourable for driving, being at 7*s.* per foot, the party paying all their cost. I think there is every probability of our having to drive another 200 feet before we reach the main lead to the west; this will take about six weeks to accomplish. The south drive has been extended 125 ft. from the jump-up. The drive passed through wash varying from 1 to 2 feet thick for about 30 feet south of jump-up, but at this point it ran out, and the drive continued in clay and fine drift until we reached 57 feet. At this point another run of wash struck, varying from 4 to 5 ft. high, and continued south for 40 feet, then dropping to 2 feet thick, which continues up to the present time. To ascertain the direction of this wash a drive was thrown off to the eastward near the place it was first cut, and continues 72 feet; at a distance of 24 ft. from the opening of this drive we crossed a run of ground coming from the direction of the shaft, and proceeding towards that already passed through in the south drive. The reef in the eastern drive has been pretty nearly level all the way, with a little wash varying from 6 in. to 1 ft. thick, the roof is stiff black clay, showing that the high reef near the shaft does not dip far in a southerly direction, but that a large reach of flat ground has been covered by a sedimentary deposit. In blocking out a portion of the thick wash we have crossed the shaft run three times, and on two occasions have found a small nugget, besides a sample of coarse gold, a fact when taken into consideration with others on which an opinion may be ventured that the little gutter the shaft bottomed on is only a blind gutter, which conducted a wash through it only in times of the overflow of the main creek. The wash brought down from the high reef on the north and west with great velocity kept the channel from silting up, and always open to carry down storm water as a bye wash. The lead at the end of the blocking drives is dipping fast, and we shall follow the run so long as possible for water before resuming the main drive in the bottom chamber. I have every hope that the present gutter will take us into the main wash in a south-easterly direction. The west drive in the south has been driven 30 feet, wash from 2 to 3 feet thick. A machine of this dirt will be tried in the ensuing week. I regret I am unable to finish the plan of the mine in time for the mail. The bore has struck black clay at a height of 24 feet from western level. The machinery, &c., is working admirably.

ANGLO-AUSTRALIAN (Gold).—Capt. J. Raisbeck, Aug. 13: Engine-Shaft No. 1: Present depth, 173 ft. 6 in.; no change in ground worthy of notice; water a little quicker.—No. 2 Winze: South drive extended to 63 ft., lode 18 in. thick. Working stopped for the present.

SCOTTISH AUSTRALIAN.—The directors have advices from Sydney, dated Aug. 10, with reports from Lambton Colliery to the 6th of that month. The sales of coal for the month of July amounted to 14,100 tons.

FOREIGN MINES.

ECLIPSE (Gold).—Capt. Barratt, Sept. 5: Since writing you on the 25th ult. the end being driven on the course of the lode in the mountain, south of cross-course, has maintained its width (8 feet), producing at intervals samples of auriferous ore, but not sufficient to mill. The end is driven 30 feet from the face of the mountain, has a very good appearance, and I expect will soon come into good pay ore: this end I have suspended for the present, and put the men to force on the cutting down the main shaft to put in track (railroad), fix whim, &c. All the operations in main shaft on old mine are suspended until the track, &c., be fixed. The engineer has been busily engaged fixing bed for cylinder, &c. All our machinery is on the road from San Francisco; immediately it arrives it will be put together, and I hope be in working order, and returning gold by Christmas. All surface operations are progressing as fast as possible.

EXCHEQUER.—Lewis Chalmers, Sept. 10: Bulliona: I advised you on the 31st ult. that I had completed the purchase of the Davidson Mill. The title deeds of the Sonoma claim are now before me for examination, and this matter will soon be disposed of. My survey of the mines, &c., is well on. We are now down to the 79 in the winze, or within 1 ft. of where my survey makes the extension of the Fremont tunnel cut the Exchequer winze, allowing 1½ ft. for fall on the drift for water. The north drift is in 107 ft., and several cross-cuts being made. The Accacia tunnel is in 58 ft., and work has been resumed in the air-shaft. Water has been troublesome from the north drift, but is on the decrease.

BATTLE MOUNTAIN (Nevada).—W. Nancarrow, Sept. 13: Virgin Lode: In the 73 ft. level north the lode is 4 ft. wide, and for about 5 ft. from the bottom of the end a very good lode. It appears that we are driving over a large deposit or bunch of copper ore; for the last 20 or 30 ft. the lode has always been best in the bottom of the level; this level is driven north 112 ft. altogether from the Virgin shaft, and I am in daily expectation of a great improvement here. The south stope, in the back of this level, is nearly worked out, or, in other words, worked back near enough to the shaft, for we are obliged to leave a piece of ground near the shaft for the security of the same. The north stope just now is not looking so well—more waste dirt in the lode. The level just under was not so good, but we have a good lode before us yet also above.—Lake Superior Lode: In this we have again commenced to drive south, and the lode, although broken up by the slide, appears good enough to hope for a speedy improvement; this end is driven 41 ft. from the shaft. I should also like to drive north as well, now that the air is good, if I could see my way clear to employ more men; this end is driven 50 ft. from the shaft.—Hallow's Ledge: On this ledge the shaft is down 53 ft.; the lode is 4 ft. wide, and improving as we sink. We have began to sack some ore here, and have now on the dump 58 sacks, filled on Saturday and yesterday; this ore is not of very high grade, but very similar to the Lake Superior. I believe it to be a continuation of the same ledge. We shall have now soon to make a road, so as to get the trains here to load. We are still taking out large quantities of ore from the Virgin, and shall have by to-morrow morning 1100 sacks down at the railway station, and if we could get more teams should have a good deal more down. We have now at the mine 700 sacks filled with ore. The ore-house is still as full as it can hold; there is quite 1000 sacks in it. We sort by day and sack by night, otherwise we could not keep it away. I go down to the station again to-morrow, to send down to San Francisco the 1100 sacks—that is, if I can get cars.

NEVADA (Land and Mining).—The accounts of the operation of the company's mill at Reno for the 15 days, from August 12 to 27, have been received, and show that 158,359 lbs. of custom ores were received from various sources, realising $16,468; the amount paid for the same was $11,232, giving a profit of $5236. Up to Aug. 26, from the Alpha Mine 83,486 lbs. had been received, the value of which was $3920. Total profit from custom ores and Alpha Mine, $9154; less wages, chemicals, &c. From the Pinto Mine, between Aug. 8 and August 31, three lots of ore were shipped to San Francisco, amounting to 45,300 lbs., averaging $270 per ton, on which an advance of $1704 had been obtained. The directors regret that owing to a mistake in the paragraph appearing in the *Mining Journal* of Sept. 24, the words "half-yearly net profits" were used instead of "yearly net profits," and a statement that part of these had been applied to payment of the purchase money of the Pinto Mine, and part to meet other liabilities, was inadvertently omitted.

NEW ROSARIO (Silver).—Extract of a letter received from Senor Don Juan Potts, of Mexico, dated Aug. 27:—I have a full understanding with Captain Grose respecting what is to be done, and according to our estimate and present appearances the San Pedro adit ought to reach the San Francisco vein in about two months. The Encarnacion shaft will soon have the whim erected, and the shaft itself will immediately be put in order for work, so that I trust we shall shortly be able to communicate encouraging news.

WEST CANADA.—Capt. F. Williams, Sept. 14: Huron Copper Bay: We are now making good progress in sinking Stephen's winze, and hope to get it down to the 50 by the end of the year. The lode is much the same as when last reported on, and still yields 2 tons of ore per fathom. The stope below the 20, east of this winze, is looking rather poorer than it did a week ago, but no doubt it will soon improve again; it produces at the present time over 2 tons per fathom. The stope in the bottom of the 35, west of Palmer's shaft, is still worth 2 tons per fathom. We hope next week to commence working this stope, where the lode is much more productive. The stope over the 35, east of Bray's engine-shaft, is improving as we get further away from the winze; it yields at this time 2¼ tons per fathom. The stope east of this shaft, and west of Bartle's winze, below the 35, is worth 2¼ tons per fathom. The stope below the 20, east of this shaft, and west of Carmichael's winze, is still idle, and the men employed at the new works. The lode in the 50, west of Palmer's shaft, is again looking splendid, and produces fully 4 tons per fathom. The stope in the bottom of the 50, west of shaft, is looking well, in fact, yielding as much as we anticipated; it produces 3½ tons per fathom. The 60, west of Palmer's, is unproductive, but no doubt it will soon improve again. The 60, east of Bray's, produces 2¼ tons. Bartle's winze, sinking below the 50, east of this shaft, has a little improved of late, and it now produces 2½ tons of ore per fathom for the length of the winze (9 feet).—Wellington Mine: The stope east of Rowe's shaft yields 3½ tons per fathom, and the stope west is worth 3 tons per fathom. Everything connected with the new works is being pushed on as fast as possible.

RHENISH CONSOLS.—Capt. Sweet, Oct. 3: Christiania: Through the dryness of the weather the top water is again too slack for the wheel to keep the water below the 20, consequently nothing has been done in the bottom of this level for the last few days. This sink is about 2 lachters below the 20, and 1 lachter deep; the lode in the bottom will afford 1½ tons of lead ore per square lachter; price paid for sinking 60 thalers per lachter, and we keep the water out with a hand-pump. We have set a tribute bargain in bottom of the 10, west of cross-cut, to four men, at 1 thaler per centner for clean lead ore. [illegible]

PESTARENA UNITED.—Thomas Roberts, Thomas Warne, Sept. [illegible]: Aquavite Mine: We are pleased to say the lode in the end, driving north in the 55 fm. level, has improved, yielding at present 9 tons of ore per fathom, worth 1 oz. of gold per ton. [illegible]

VAL ANTIGORIA (Gold).—Thos. Roberts, Oct. 3: We retorted the amalgam, and melted the gold for September month, and consigned the same, one ingot weighing 772 grammes, equal to 25 ozs. 1 dwt. 12 grs. This gold was obtained from 52 tons of ore.

PACIFIC.—The directors have advices from their manager at Lander Hill Mine, dated September 9. [illegible]

SWEETLAND CREEK (Gold).—The directors have received the usual diary of events at the mine for the week ending Sept. 10. Everything is progressing in a satisfactory manner, and the agent was preparing for the clean up, particulars of which have been already published in these columns.

LUSITANIAN.—[illegible]

PONTGIBAUD.—W. H. Rickard, Oct. 1: Roure Mine: [illegible]

[For remainder of Foreign Mines see to-day's Journal.]

GETTING COAL.—Mr. C. BARTHOLOMEW, Doncaster, has now invented a coal saw, consisting of two or more parallel saw plates, riveted or bolted together with a space or spaces between, in such a manner as to allow of the dust or sawdust to pass readily away between the plates, and the teeth of the saw blades are grated in such a manner as to remove a sufficient breadth of coal to permit the entire thickness of the coal saw.

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